THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXVI. No. 2135.] LONDON, APRIL 12, 1904. [56TH YEAR. PRICE 6d.

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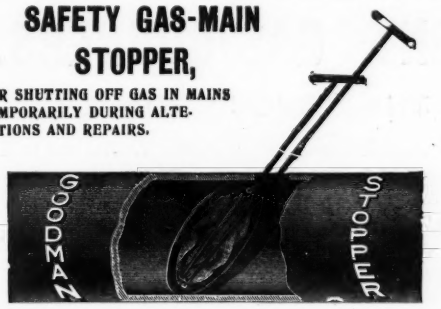

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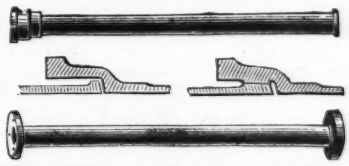

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Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.

Samples and Prices may be had on application.

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RETORT SCURFER

Saves its Cost many times each Year.

TESTIMONIAL.

WRITE FOR FULL PARTICULARS.

RESULTS GUARANTEED.

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GENTLEMEN,

We have now had your Retort Scurfer at these Works for over Twelve Months, and having tried several forms of de-scurfing Retorts, we have no hesitation in saying that it is by far the best Apparatus we have tried for this purpose. **Two men have several times drawn a Setting of Seven Retorts, thoroughly cleaned the same, and charged the Retorts again within 6½ hours.** As a matter of fact, it is unnecessary for a Retort to be out of use more than 40 minutes for scurfing purposes if your apparatus is used.

After being subjected to the blast of steam and air which is injected, the scurf is easily removed with a bar without violence and consequent damage to the Retort itself.

I am, yours faithfully,
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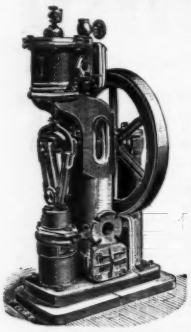


Fig. 705. "SINGLE RAM" STEAM-PUMP.

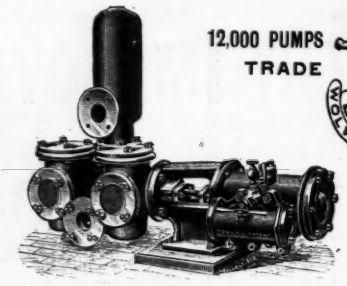


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

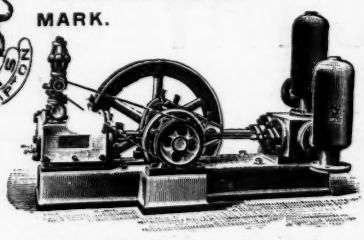
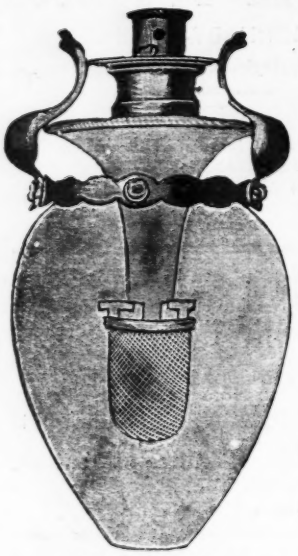


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

The Latest Novelty in Gas Lighting is the

PATENT INVERTED INCANDESCENT GAS-BURNERS.



One-third full size.
Price: Burner with Mantle, 6/6.
Globes from 8d. each.

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The most up-to-date and economical system of gas lighting, artistic in appearance and absolutely shadowless, and readily attached to existing fittings.

A BRILLIANT WHITE LIGHT OF 65 STANDARD CANDLE POWER.

Gas Consumption only 3 cubic feet per hour.

The decorative appearance of Electric Light at one-tenth the cost.

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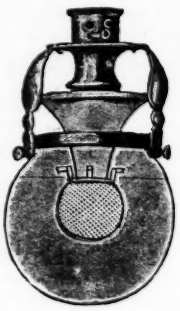
Is the nearest approach to Electric Light, and lends itself more than any other gas-burner to private house lighting, having an exceedingly pretty effect when fixed in clusters of 2, 3, or 5 lights.

20 standard candle power.



Consumption of Gas, 1 foot per hour.

One-third full size.
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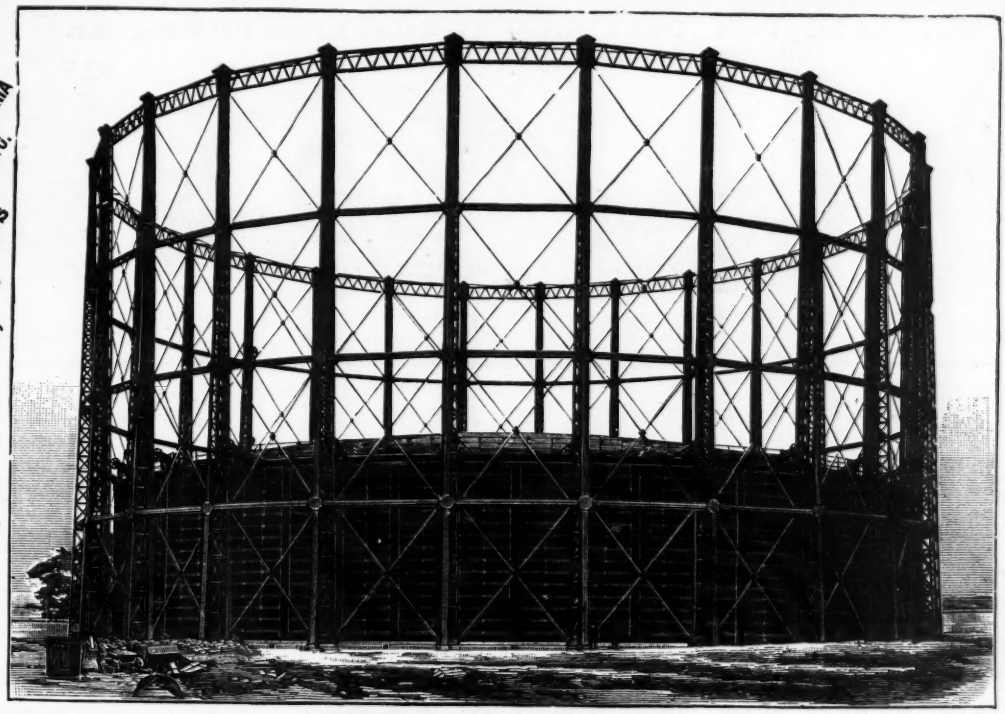

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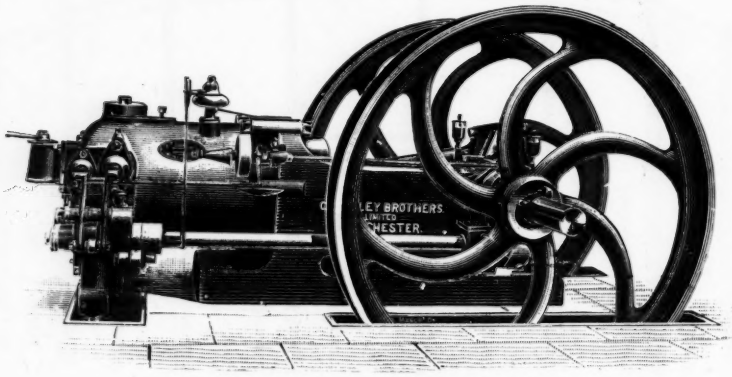

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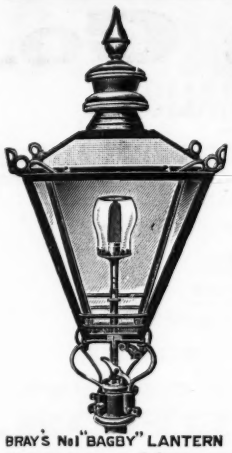

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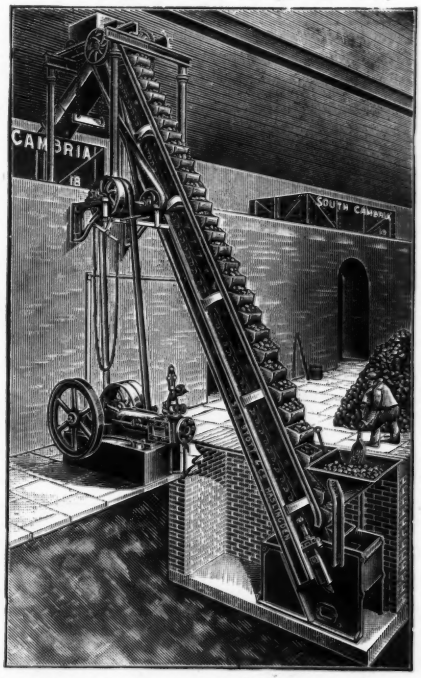

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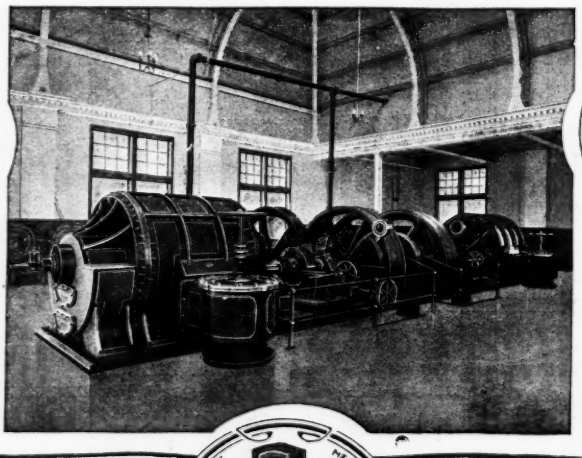

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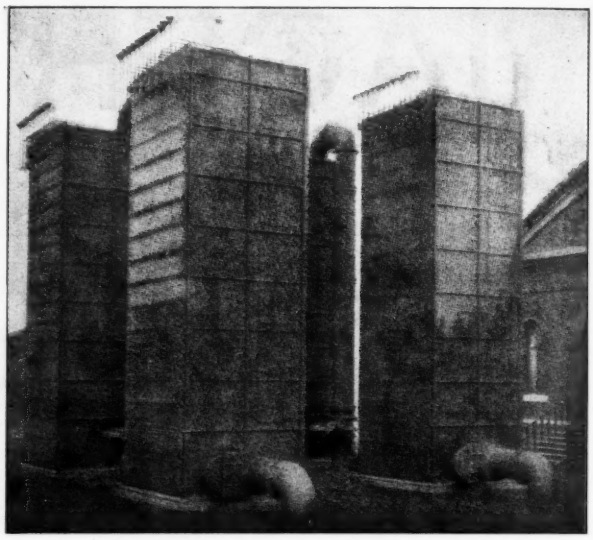

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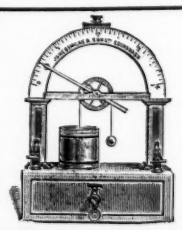

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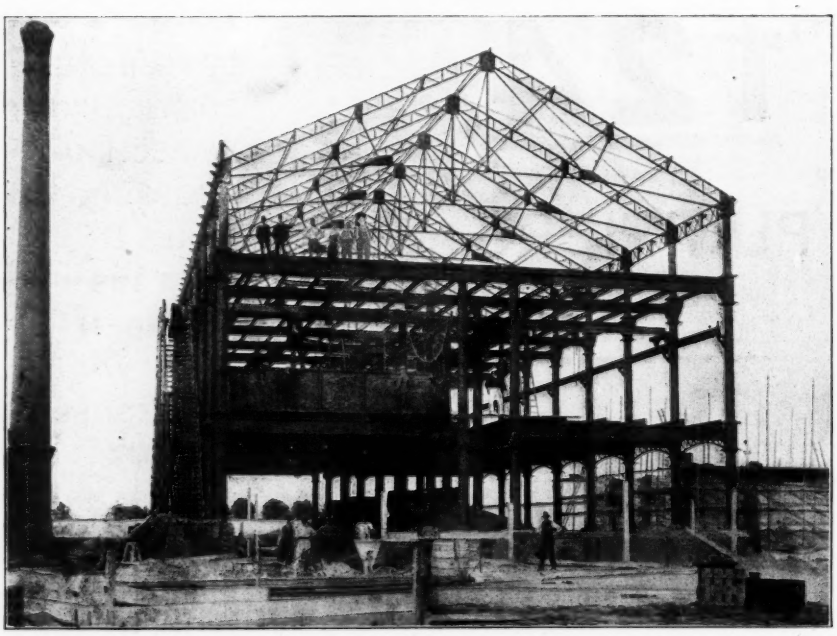

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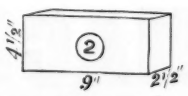

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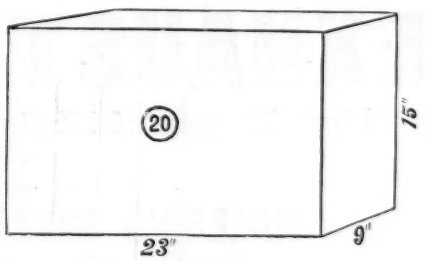

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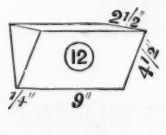

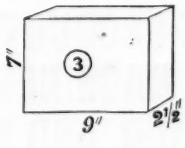

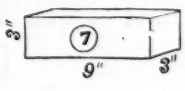

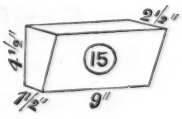

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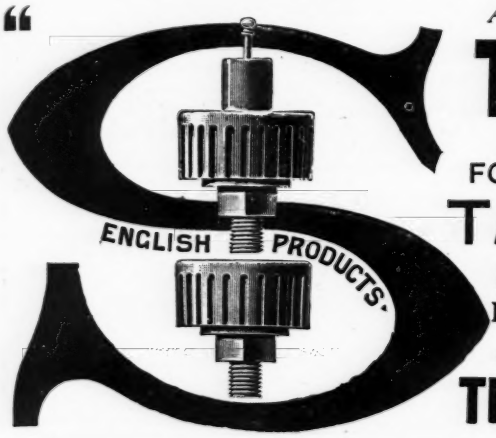

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EDITORIAL NOTES—GAS, &c.

Clearing the Way for Affiliation.—The Resolution of the Council.

APPREHENSIONS and difficulties—some genuine and others more imaginary than real—in connection with the proposed affiliation of the District Associations with the Institution of Gas Engineers, are not going to be allowed to obstruct the union. It has only required one good conference of the Committee appointed by the Council of the Institution with the Presidents of the various District Associations for the agreement of proposals which will level-down the rough places which have been discovered in the road to affiliation. This conference took place on Thursday morning last week—preceding a meeting of the Council. It is understood that the Presidents of all the District Associations (excepting of the North British Association, whose Committee, as recently announced, have resolved not to enter into the scheme) were there to represent their organizations. Even the President of the Irish Association came over specially for the purpose. Regarding the Presidents as the spokesmen for the local bodies, and the members selected by the Council from their number as the guardians of the interests of the Institution, it appears that one and all approached, from their respective standpoints, the numerous questions introduced as the result of the broad examination the general subject has received, with the single object of arriving at means of settling them all; and they were successful in producing a series of recommendations which the Council have had no difficulty in accepting. The points debated show the usefulness of the discussions, and the full reports we gave of them, at the recent meetings of the District Associations.

The objection that has been made, that the Articles of the Institution do not provide for affiliation through the rules empowering the formation of Local Sections, has been admitted by the Joint Committee to be a valid one; and they, it is understood, recommended that adjustments be accordingly made in the Articles. It is not considered necessary to abrogate those which refer to the Local Sections; the Committee believing that additions can easily be made to cover the affiliation of the several existing Associations. It follows that, as the provisions as to the formation of Local Sections do not apply to affiliation, neither does the one empowering the dissolution of such Sections at the discretion of the Council. Therefore, as (we take it) there are to be some special provisions for affiliation, there need be no fear of the Council having any arbitrary authority in the matter of determining the life of any Association. The elimination of the existing "Local Sections" Articles need not, under the circumstances, be further considered; the bond between the Associations and the Institution being of an altogether different kind from that contemplated by those Articles. The much-debated point as to the position of those Associations whose roll includes members who are not qualified for membership of the Institution is not regarded by the Joint Committee as a serious one. They hold, as it has been held in the "JOURNAL" all through, that it is the Associations in their collective character, and not individuals, that are intended to be affiliated. In other words, that affiliation will not confer any special rights on individuals (in respect of the Institution) who are not qualified for membership of that body; but they will enjoy such benefits as may accrue from affiliation to their particular organization and to the gas industry generally.

The suggestion of the Midland and Irish Associations, that there shall be an affiliation fee, was included in the recommendations; and the proposition of the former that its amount shall be five guineas is endorsed by the Joint Committee. Regarding the remission of the entrance fee for those qualified members of the District Associations who may desire more intimate relationship with the Institution than the affiliation of their local organization would give them, it has been determined that this privilege shall only extend over one year from affiliation taking effect—some far-seeing member of the Committee having discerned the possibility, in the perpetuation of this act of grace, of qualified men making a temporary membership of an Association an inexpensive way of gaining admission to the Institution. The limitation was therefore agreed to. Another matter which has undergone change through the conference has reference to the direct representation of the Associations on the Council of the Institution. This is an important inducement to affiliation. The idea, however, was that the President for the time being of an Association should be the representative of his Association on the Council. Several very sound reasons against representation being limited to the President were advanced; and there has been some relaxation to the extent that an Association may delegate any member of their own body, being a member of the Institution, to represent them. This overcomes the objection raised, that Associations would be confined to the election as Presidents of gentlemen who are members of the Institution. The alteration relieves them of any restraint in this regard; and they will further be able to elect the most suitable man from their number to join in the counsels of the Institution's Executive. The recommendations show a fervent desire to remove all obstacles to the bringing about of a confluence of interests that, it is believed, will be fruitful of the highest advantage.

After the foregoing was prepared for publication, the Hon. Secretary of the Institution (Mr. James W. Helps) communicated to us the recommendations adopted by the Council after the meeting of the Joint Committee. A copy of these will be officially forwarded to each District Association at an early date; but, in the meantime, it may be of service to publish them: "(1) That the names of the Local Associations be retained, and that the rules of the Associations shall not be subject to revision or alteration without the consent of the Local Associations. That any member of a District Association not eligible as a member of the Institution shall have no claim to the benefits and privileges of the Institution. (2) That the management of the District Associations shall be in the hands of the Committee appointed by its own members, and the finances of the District Associations shall be under the control of the Committee. (3) The District Associations shall select a member of their body who is a member of the Institution of Gas Engineers who shall become an *ex officio* member of the Council of the Institution; and the District Associations shall pay an affiliation fee of five guineas. (4) That members of each Local Association (who are qualified to become members under the Articles of Association of the Institution) shall be eligible for election to the Institution without entrance fee for a period of twelve months after affiliation."

International Gas Exhibition at Earls Court.

AFFILIATION was not the only question under the consideration of the Council of the Institution of Gas Engineers on Thursday. From the Honorary Secretary we also learn that a report was received from the Special Committee appointed to deal with the question of holding a Gas Exhibition towards the end of the present year. The matter had a very careful and full discussion; and it was finally resolved that the Institution should give their support to an exhibition of an international character to be held at the time mentioned. The Council have decided that all arrangements shall be placed in the hands of Mr. Bridges, of Finsbury Pavement, E.C. (who is stated to be a gentleman of considerable experience in connection with exhibition affairs). It is proposed that he shall undertake the whole financial responsibility and details of organizing, and act under the general direction of an Advisory Committee. Earls Court has been selected as the most suitable place at which to hold the exhibition. The Council also decided to issue an appeal to the Gas Departments of Corporations, and of Local Authorities, and to the Gas Companies of the

United Kingdom, inviting contributions towards a fund to be formed to defray expenses incidental to the promotion of the objects of the Exhibition. It was further resolved that the Institution should take steps for the holding of conferences, lectures, demonstrations, &c., and possibly to offer prizes for purposes connected with the advancement of the gas industry and the associated arts and sciences. The Special Committee presented a comprehensive syllabus showing the proposed scope of the Exhibition; and it may also be stated that it is the intention of the Institution to obtain the co-operation, if possible, of the various Societies representative of the gas industry on the Continent and in the United States.

The Metric System in the Gas Industry.

In our "Correspondence" columns to-day will be found an interesting letter on the metric system as applied to the gas industry, from one who can claim experience, as a gas manager, of both this and the Imperial standard system of weights and measures. The communication was evoked, apparently, by recent editorial comments in the "Journal" upon the pending inquiry by the House of Lords into the possibility of making the adoption of the metric system in the United Kingdom compulsory in about two years' time. We should welcome other letters on the subject, which has often been discussed in these columns, not without recognition of its merits, nor without full admission of the imperfections of the existing British system. Many gas engineers, not excluding the present writer, have tried both; and some are in the exceptional situation of having to pass daily and hourly from one to the other, as they give their attention to home or foreign gas interests. Many Continental gas-works are administered from this country; and it is probably correct to say that in all these cases the convenience of the metric system, and especially the simplicity and fewness of the units both of currency and measurement, are fully appreciated. The old saying stands good in this particular connection, that when English gas engineers find themselves in Rome, or wherever else the metric system is practised, they are well content to do as Rome does. But that is not to admit that all Britain can be properly forced to copy the example of Paris or of Rome in a couple of years—having hitherto given not the smallest indication of any desire to do so.

Our correspondent justly refers to the "practical way" of the English people, as competent to settle the question of the adoption of the metric system; and it is almost enough to point out that this appeal has already been made, and has gone against the proposition. Not a single English-speaking community, in either hemisphere, has ever taken willingly to the metric system for business purposes. It is open to any manufacturing or mercantile firm in Greater Britain or in the United States to use the system for their private purposes; and, having regard to the keenness of competition, it is difficult to believe that if it really contained the possibility of such economies as some contend, its use would not long since have become a feature of this competition. As a matter of fact, though a few makers of electric plant and machinery in England work by the metric system for their own ends, and both chemists and physicists employ it in their calculations, the law of the survival of the fittest cannot be referred to in its favour in respect to speakers of English. Whether or not any English gas directors admire the system, to the extent of being willing to try the experiment suggested by our correspondent, the fact would remain that to change the consumers' meter-indices and charge for gas at (say) 1·1d. per cubic metre, would be to speak an unknown tongue to the populace, who probably would resent it in the vernacular. And to what end? There would not be the smallest real inducement to make such a change. The expenses would have to be borne by somebody; and it is hard to believe that the recompenses enumerated by our correspondent—the consumer's greater facility in reading his meter, and so forth—could be expressed in terms of pence per 1000 cubic feet.

Though our correspondent does not mention the fact, the "sweet simplicity" of the metric system in respect to charging for gas, is closely bound up with the fixity of gas prices prevailing under the Continental gas polity. Moreover, this system always goes with the currency, so that the cubic metre of gas costs so many centimes, or pfennige, or whatever is the suitable coinage. There is no precedent in the world for stating the price of gas at "1·3d. per cubic "metre"—an impossible figure. How can any man be indebted for an amount which it is beyond his power to legally tender? The truth of the matter is that, from the practical man's standpoint, the comparison between the two systems is not that of a perfect system with an imperfect, but of one system of mixed quality with another. As things are now, the ordinary British citizen is not required to trouble himself about a second system of weights and measures, chiefly for purposes of computation on paper, like the German, the Frenchman, or the Italian. These peoples habitually think in one system and write another. The ordinary man (still more the ordinary woman) has little use for, and less understanding of, decimals. Men must be pretty well schooled before they appreciate the facility of decimal fractions for computing. Our self-made men, whom the world could by no means do without, never employ decimals, which are useless for mental arithmetic. That is how the practical Englishman or American settles the question, unknowingly. He does not want a metric system, and would certainly become a "passive resister" to any statutory order for its use. It is a curious reflection that, although the United States currency is decimal, the nation has made no further advance towards the systematizing on the same principle of its weights and measures, in spite of the fact that a very large proportion of its population is derived from metric countries. There must be something amiss with an invention which cannot cross the Straits of Dover nor the North Atlantic, notwithstanding the paper credentials with which it is so well furnished.

Budget Anticipations.

During the whole of last week the newspapers were busy with some more or less intelligent anticipations of Budget proposals. It being known that the Chancellor of the Exchequer would be in the painful predicament of having to face Parliament with a deficit on the past year's public revenue account—thanks to his predecessor's optimism—the temptation to "make shots" at the nature of the course to be taken by the Government with the object of restoring equilibrium to the national finances, was irresistible. Any newspaper which could score a point at this fascinating game would pardonably plume itself on its perspicacity for at least a week after Budget night, which is the space of an eternity for modern journalistic renown. Some time ago, the Chancellor of the Exchequer yielded to the importunities of the coal trade, moved by the pressure of the contracting season, so far as to engage that the export duty on coal should not be raised this year. There has been a good deal of controversy in regard to the coal duty; opinions ranging all the way from a demand for an impost of 5s. per ton at least on the best Welsh smokeless steam coal (on the ground that foreign navies should be made to pay smartly for this indispensable) down to the usual trade plea for its complete removal.

The way to a sound judgment on this particular issue appears to lie through a fair understanding of the statistics of the trade. So far as our study of the figures has extended, it has confirmed the opinion all along maintained in these columns—that a duty of this character is borne by the party which has the greater desire to deal. Thus the duty on the choicest steam coals, and on the best gas coals, which the foreign buyer will have at almost any price, is paid by him. On the other hand, the coals which are offered abroad for what they will fetch, in competition with foreign supplies, have to bear the disadvantage of the duty, in addition to every other charge upon the marketing. It is contended that a large and increasing proportion of British exported coal is of this—we will not say inferior, but at any rate non-preferential—character. The progress of the movement in favour of low-grade gas is said to be cutting off at its source the need for the best qualities of English gas coals. Consequently, such coals have no preferential value in the foreign market. Their quality, of course, remains what it was; but if there is no effective demand for it, the price will not be forthcoming. With regard to the supreme value of Welsh smokeless steam coals to foreign navies, it is pointed out that this is really a very small consideration in comparison with the bulk of the trade. It is at best a war premium, and, even so, not likely to endure for very long, as the course of events in the Far East has demonstrated. These considerations, while they may not be held to be sufficient to

warrant the removal of the export duty on coal, are serious enough to prevent any increase in its amount.

A "hare" that was started in the course of the week, and gave some sport, was the idea of a tax on imported mineral oil and spirit. Of course, the sound of a tax on petroleum was differently received in various quarters. The Scottish shale oil trade shouted for joy—rather prematurely, most people thought. The temptation to test people's political principles by an appeal to the pocket is always strong; and the spectacle of the stern and unbending Free Traders of the Lothians under the attraction of a duty of a penny on foreign oil would be worth looking at. But the suggestion was not treated seriously by the City. There are too many opposing interests. The imputation of taxing the light of the poor is something that no Government would willingly bear, especially one that has nearly run its natural course. The idea of putting a tax upon the petrol used by the road motorist would not cause an insurrection; but the proceeds of such an impost could not be considerable. One or two newspapers fell into the delusion that a petroleum tax could be made instrumental in penalizing the low-grade American burning oil which the wicked "Trust" is supposed to be "dumping" in this country at a cheap rate. Apparently the writers of these criticisms and comments never buy any oil themselves, or they would know that what is classified as "Ordinary American" is just about ½d. per gallon dearer than Russian. Any idea of adjusting a petroleum duty to the flash-point, with a view to the protection of the Scotch trade, is too fantastic for discussion. With regard to gas oil, which is a raw material of manufacture, the notion of a tax is dead-against the canons of a reformed fiscal policy. While thinking these thoughts, it is difficult to resist the recurrent reflection that the Chancellor of the Exchequer will be extremely fortunate if he is able to frame his Budget without having recourse again to that patient animal, the income-tax payer.

Local Government Finance.

EASTER seems to be generally regarded as the proper season for striking the balances of the national finances; and it is therefore the appropriate time for the publication of statements and criticisms relating to the different aspects of the financial situation. We have already commented upon Budget prospects and proposals; and have now to notice the annual local taxation returns for England and Wales just published. These are two years behind the account period, which is for the municipal year 1901-2. The delay in publication is regrettable; but probably this cannot be helped, having regard to the volume and character of the statistics. The number of local authorities who had financial transactions during the year is 28,322. These bodies raised altogether a total revenue of 121½ millions sterling; which was an increase of 10 millions on the previous year. Of this amount nearly 46½ millions, or 38 per cent., was obtained in the form of rates; 12½ millions, or 10·3 per cent., came in the form of grants from the Imperial Treasury; and nearly 15½ millions, or 12·6 per cent., was revenue produced by the undertakings classified as reproductive. Another 34½ million is entered as being borrowed. The outstanding loans of the local authorities at the end of the year amounted to 343½ millions, of which sum upwards of 159½ millions, or 46½ per cent., stood in respect of undertakings which "are or may "be reproductive," such as water-works, gas-works, tramways, and electricity supply works. The rateable value of England and Wales is put at 186½ millions, in which is included 24 millions for agricultural land. Calculated upon this basis, the average rate in the pound of the public rates raised during the year was 5s. 3·8d. in respect of houses and other properties assessable in proportion to the full rateable value, and £1 8s. 6d. per head of the estimated population.

The foregoing figures do not convey very much meaning unless they are regarded in the light of a wide knowledge of the purposes to which the money is applied. They are the representation, in terms of cash, of the most extensive and the highest order of local government in the world. In no other country are the local administrative bodies so responsible, or have so much to show for the money that they spend. They have, of course, the defects of their qualities. Within the last few years they have also begun to feel, as they never felt before, the strain which the satisfaction of their need of capital puts upon the monetary resources of the community available for investment. It used to be the stock argument for the municipalization of public services otherwise performed by private enterprise, that local authorities could raise capital at less cost than joint-stock companies. This was true up to fifteen or ten years ago, when, though a wise Legislature insisted that municipal capital borrowings should be repayable, the repayment thereof was spread over long periods. The borrowing, also, could be done at a low rate of interest. Since that period, however, the character of municipal finance has greatly changed, though by gradual and imperceptible degrees. Municipal loans have become dearer, and the practice has grown of fitting the period of repayment to the estimated life of the object for which the money is wanted. The net result is to make 4 per cent. interest and 2 per cent. sinking funds common in municipal finance, which is certainly a steadying consideration.

The fact that many municipal corporations have adopted the policy of opening loan offices, with the object of obtaining money from anyone who will advance sums ranging from £50 to £1000, is a sign of the times. It does not signify that such loans are cheap, but only that there is a felt necessity for appealing to the private investor without the intervention of the Stock Exchanges. For reasons which it would take too long to go into, the exchanges have been unable for two years past to maintain the value of high-class investments. It is with considerable satisfaction, however, that the advent of a better state of things can now be reported. The best authorities on the subject confess that the aspect of business "presents features of real "encouragement to the Stock Exchange." Investors are said to have been attracted by the low prices ruling for the highest-class investments; and the big houses who have had their resources locked up in these funds are getting their hands free, and have no more of these securities to sell. Gas shares will participate in the improvement, and the relief will be general—always assuming, of course, that nothing untoward happens in any part of the world, and that British Local Authorities are not in too great a hurry to choke the market again with their stock issues. There is reason to fear, however, that some of these authorities may not be able to help themselves in this respect, as they are committed to costly tramway electrifications, for which more money is needed than can be raised locally. This is unfortunate, in more senses than one; and it constitutes the blackest spot in the financial outlook. Many of these schemes must prove unremunerative; so the probability is that municipal finance is preparing another disillusionment for itself.

The Law of Taring Waggons.

A POINT of law of some commercial importance was recently disposed of by a Divisional Court. It stood in the names of *Beardsley v. Pike and Another*, and was a case stated by County Justices who had dismissed an information under section 22 of the Weights and Measures Act, 1889. The charge in the information was that the respondents failed to insert in a ticket required to be given by them, a statement of the correct weight of the vehicle in which a quantity of coal sold by them exceeding 2 cwt. was conveyed to the purchaser, and of the coal contained in the vehicle. The appellant proved that, on delivery of a load of coal on a particular date, the tare weight of the waggon was entered on the ticket as 10½ cwt.; whereas after delivery the waggon was tared, and its actual weight was then 11 cwt. There was no explanation to account for the discrepancy in weight. The respondents contended that, the waggon having been tared three days before the act of delivery in question, and then found to scale only 10½ cwt., there was no obligation upon them to have it weighed previous to the delivery three days afterwards. The Justices held that the respondents were not obliged to check the tare of each waggon prior to every delivery in bulk, but only at reasonable intervals; and, in the circumstances, they declared that the requirements of the Act had been complied with. The Court, without laying down any rule, decided that the Justices were wrong. The waggon must be weighed before every act of delivery; and, to fulfil the requirements of the statute, it ought always to be weighed, if there was any reasonable ground for supposing that its condition had changed. The case was accordingly sent back to the Justices. In view of the large amount of sale and delivery of coal and coke in bulk, this decision is of considerable moment to merchants and dealers. It is to be interpreted as meaning

that the tare weight painted on waggons is not to be regarded in law. There is often a tussle over the weighing of vehicles used for delivering goods in bulk; and it is well to know that everyone has a legal right to have such vehicles tared every time they are so used.

The Waverley Association Meeting.

The meeting of the Waverley Association at Dunbar last Thursday was not distinguished by much that induces comment. If one thing were more notable than another, it was the address of the President—Mr. Peter Blair, of Haddington—which gives point to the impression already formed of him, that he is a thoughtful and resourceful Manager. This was his second Presidential Address; and in it, as in the first, he confined himself strictly to his own working, and to a limited portion of it. In this way not only were his hearers saved from the weariness of a discursive essay upon everything in general, but his views were expressed so clearly, and in a form so well ordered, that their import could not be missed. Their educational value was thus highly enhanced; and the members had no difficulty in following with a discussion which bore the ring of practicality. The Waverley Association are to be congratulated upon their flourishing condition. No mention was made of the subject of affiliation with the Institution, which was surely due to an oversight. It can scarcely be accepted that if the Association had been consulted they would not have had something to say in the matter. If they have been left out of the scheme, is there not still time for their inclusion in it? The Waverley claim to be the oldest of all the Associations of Gas Managers; and there does not seem to be any obstacle to their agreeing to affiliate—if they were asked.

Municipalities and their Electricity Undertakings.

Tunbridge Wells has already, on a recent occasion, had a great deal more attention devoted to its municipal trading affairs than has been bestowed on many more important places. Some time ago, after entering into competition with the National Telephone Company, the Council sold their plant to the Company—to the great disgust of those who would like to see our local governing bodies set themselves up as Universal Providers. Now these good folks have received an even greater shock from the same town, for the Council have actually been considering the advisability of accepting an offer they have received for their electricity works. It is true that a decision in the matter has not yet been come to, but that such a proposal should be even for a moment seriously entertained is in the highest degree significant. With transfers of commercial undertakings from the hands of companies to those of local authorities, we have all for a great many years been familiar; but the reversal of this procedure introduces an altogether new series of considerations. Corporations have usually been desirous of acquiring properties that had proved highly profitable in private hands; whereas capitalists will most probably only have the opportunity of purchasing from them concerns that have proved a disappointment. In discussing the question of parting with its electric installation, Tunbridge Wells is, of course, only following the example set by Willesden and Watford; but it is more fortunate than the last-named place, whose intimated willingness to enter into negotiations with would-be buyers met with no response. In other respects also the two cases do not seem to be quite the same.

An Offer at Tunbridge Wells.

The Watford venture had been a losing one since its inception; whereas electric lighting at Tunbridge Wells is reported to have shown a profit in all but one of the seven years of its existence. Certainly the gain is not a large one—only reaching altogether about 10 per cent. on the outlay—but still it is something on the right side. Such a return, however, would be considered totally inadequate if the money had been subscribed by private investors; and yet the offer made for the concern is the repayment of the capital expenditure (some £71,000), together with a bonus of £10,000. What can be the meaning of this, except that capitalists see their way to make the concern much more profitable than the Council have been able to do? From no other point of view could the offer be justified; and in no other light would it have been made. Doubtless the reply to this will be that the first aim of municipalities is not to make profits out of their undertakings, but to secure for the ratepayers a cheap and efficient service; and this is clearly the correct view to take of the matter. At the same time, it must be remembered that a company also must strive to attain this end, for their hopes of profit must rest upon their being able to offer advantageous terms to consumers. It will be seen, therefore, that this answer is not an altogether sufficient one, and that some further explanation must be sought of why private persons should consider there is a prospect of earning a satisfactory return on £81,000 with an undertaking which in the hands of the Council has only yielded a small percentage of profit when capitalized at the smaller figure of £71,000. Whatever may be the ultimate result of the negotiations, this question must remain. The ratepayers of Tunbridge Wells have plenty of time to thoroughly consider the affair in all its bearings, inasmuch as the final decision has been postponed until the June meeting of the Council; and this point should not be lost sight of by them. The explanation vouchsafed by one of the papers is that "there are those who argue that the interests of the competing Gas Company are so well represented on the Town Council that the electricity undertaking will never be so prosperous as it might be so long as it remains under municipal management." But this statement bears its contradiction on the face of it; for if a majority of the Council were bent on limiting the scope of electricity, they would certainly take care to keep the concern in the hands of the Municipality, in which case they could continue to control it, and so all this pother about the proposal to sell it to outsiders who might be relied upon to push the business for all it was worth would be needless. There is no necessity to put the case any higher than this; but if there were, we should refuse to believe that the majority (or even any) of the members of the Tunbridge Wells Town Council are so forgetful of their duty as not, to the best of their ability, to look after the interests of the ratepayers who have elected them as their representatives.

Future Lighting and Heating of London, Paris, and Berlin.

In an article published in the "Revue des Deux Mondes," M. Gaston Cadoux deals with the future lighting and heating arrangements of London, Paris, and Berlin. He says that in a not very distant future these three cities will be entirely lighted and heated by electricity and gas at an extraordinarily low price; the sea being used as the motive power to supply electricity. The current will be brought to the great towns from generating stations on the coast. The loss of current, he thinks, will be comparatively small. At present the current sent from the works at Sierras to San Francisco—a distance of about 240 miles—does not lose more than 25 per cent. in transit. M. Cadoux believes that hydraulic power furnished by the sea and by mountain streams and lakes will, at a small cost, supply London, Paris, and Berlin with high-tension alternating electric currents sufficient for the public and private lighting of these cities. It is comforting to find the writer holding the opinion that the days of coal gas are by no means over. He says it is to be the greatest and the cheapest heating medium of the early future. It will be purified, mixed with oil and other heavy bodies, freed from all danger of explosion or suffocation, and distributed as a great heat-radiating medium to private houses.

An Impertinent Querist.

Mr. Geo. Y. Pike, of Horncastle, is a man who, for his own private benefit, engages in many branches of business. His letter paper informs all who receive a sample that he sells artistic furniture, keeps a general furnishing and fancy warehouse, is a painter and decorator, and a provider of houses for the living and the dead—being both a builder and an undertaker. To all of which, there is not the slightest ground for objection; only one might imagine that, if Horncastle patronizes Mr. Pike well, he has quite sufficient for six days a week to keep his attention riveted on his own business. Apparently Horncastle does not keep him fully occupied in furnishing, painting and decorating, building, and undertaking; for, if we are not mistaken, he has lately obtained a seat on the District Council. In that capacity, he is taking an interest in the affairs of the gas-works. But his business experience in half-a-dozen different capacities, has not, apparently,

taught him discretion. From his experience, he ought to know that, when special information and advice are required in any branch of professional work, there are plenty of men willing and happy to give it—for a fee. His own action shows either that in this particular his education is deficient, or, that he is one of those persons who exercise ingenuity in trying to obtain professional opinion and advice on the cheap. One gas engineer has sent us a letter which the (ignorantly or wilfully) immodest Mr. Pike has addressed to him, in which this request is made: "Would you please give me your opinion whether it would be an advantage, or disadvantage, to erect sulphate-works at the Horncastle Gas-Works? Total population, 4000." The total population, of course, refers to the town, not the gas-works. Then, there is this equally objectionable "PS.": "Would you also please quote me price at which you sold coke in December, 1903, at per ton and 50-ton lots?" If Mr. Pike's object, in wishing to obtain advice on the cheap, is that he may pose as having special knowledge of gas matters, or if he has some secret intention of warming things up at the gas-works, he will be disappointed at his non-success in the case of our correspondent, who describes his letter as "the height of impertinence." Should Mr. Pike still desire the opinion of this gentleman on the first point, he can no doubt obtain it by approaching him in the ordinary way as a professional man.

Reported Discovery of Two New Elements.—A Laffan telegram from New York yesterday reports that Professor Baskerville, of the University of North Carolina, claims the discovery of two new elements. One he calls Carolinium, the other Berzelium. These elements owe their development to the use of thorium dioxide; and they have a high power of luminosity. It has taken ten years to produce three grains from monazite sand. They are reported to shine through copper, brass, rubber, iron, and glass tubes inserted in one another, and all covered with cloth.

Indebtedness of Municipal Authorities.—The Industrial Freedom League have issued a statement as to the indebtedness of local authorities in the United Kingdom in 1893-4 and 1901-2. For the first-named year, the figures are: England and Wales, £224,158,370; Scotland, £31,806,044; Ireland, £9,171,448—total, £265,135,862. For the year 1901-2, the figures are: England and Wales, £343,416,582; Scotland, £49,211,869; Ireland, £14,440,595—total, £407,069,046. This is an increase of £141,933,184 in eight years. It is pointed out that the above figures have only appeared separately for each kingdom; so that the totals for the United Kingdom are now published for the first time. By way of contrast, the corresponding amounts of the National Debt are given. In 1894 it was £669,104,024; in 1902, £765,215,653—an increase of £96,111,629 in eight years.

Gas Coke for Malting.—At the last meeting of the Nottingham Section of the Society of Chemical Industry, Mr. S. R. Trotman read a paper, written in conjunction with Mr. J. E. Hackford, on "The Selection of Fuel for Malting," mainly with reference to its arsenic contents. In the course of the paper, the authors explained that malting fuels were divided into four classes—good anthracite, oven cokes, low-grade anthracite, and gas cokes. They expressed a strong opinion that the position of the last will soon be altered. In the discussion on the paper, Mr. J. H. Brown (the Corporation Gas Engineer) took exception to the low place assigned by the authors to gas cokes. He said he had numerous analyses of these in which the arsenic had been put down as a negligible quantity. If the maltsters were prepared to pay a reasonable price for a gas coke practically free from arsenic, it could be produced equally as well as in a coking-oven. The processes were essentially the same; the only differences being that in the coke-oven they worked from 10 to 15 ton charges, whereas at the gas-works they would only carbonize as many hundredweights.

Calculation of Gas Analyses by Combustion.—Herr A. Wohl, writing in the "Berichte," points out that the errors introduced into the calculation of gas analyses by combustion, through the assumption that the molecular volumes of all gases are alike, are very considerable, compared with the accuracy of modern gasometric methods. The molecular volumes of some common gases, according to the latest determinations of density and molecular weight, are as follows (that of oxygen being taken as the unit): Hydrogen, 1·0017; oxygen, 1; carbon monoxide, 1; methane, 1·0020; carbon dioxide, 0·99393. Hence 100 volumes of carbon monoxide exploded with 50 volumes of oxygen yield 99·4 volumes of carbon dioxide, a contraction of 50·6; and if the carbon monoxide be calculated, as usual, from the contraction, we get for its volume $2 \times 50{\cdot}6 = 101{\cdot}2$, an error of 1·2 per cent. The true molecular volumes should therefore always be used; and the calculations in the commonest cases will take the following forms, where the symbols or formulæ indicate the volumes of the respective gases, and K stands for the contraction: Hydrogen: H = 0·6670 K; H = 2·0034 O. Carbon monoxide: CO = 1·9760 K; CO = 1.0061 CO_2; CO = 2 O. Methane: CH_4 = 0·4990 K; CH_4 = 1.0082 CO_2; CH_4 = 0·5010 O. Other cases can, of course, be easily worked out.

WATER AFFAIRS.

An Alarmist Report on London Water.

The Royal Commission appointed in 1898 to inquire and report as to what methods of treating and disposing of sewage, including the liquid coming from any factory or manufacturing process, might properly be adopted, have lately issued their fourth report. It is a volume of 316 folio pages, with introductory matter occupying eight more, containing a great mass of statistics and a large number of maps and diagrams. Judged by its bulk as compared with the previous reports, one would suppose that the branch of the subject dealt with was the very kernel of the inquiry entrusted to the Commissioners; but on looking at the title-page we find that it is the pollution of tidal waters, with special reference to the contamination of shell-fish. Further inspection of the contents reveals the fact that 310 of the remaining pages are occupied with reports by Dr. Houston on his bacteriological investigations into this question; while the last six are devoted to correspondence which has taken place with foreign countries as to the importation of this kind of fish. This is no doubt a very interesting subject, and one which affords excellent scope for the bacteriologist; but whether it required treating with the elaborateness displayed in the report is a point on which our opinion is very probably opposed to that held by Dr. Houston. However, it may be supposed that he was given a free hand; and the Commissioners will not have cause to complain that he has not fully availed himself of his opportunity. He and his assistants have gone thoroughly into the question; and their combined labours, as presented in the report, will possess as great value to future investigators as those of his predecessors have, as he frankly acknowledges, been to him. With the greater part of his work our readers generally are not concerned; but some of them certainly are with the portion constituting the first division, in which he deals with his bacteriological examination of the River Thames from a point above the intakes of the London Water Companies down to its estuary. It is to this part of the report that we now briefly direct their attention.

Samples of water were collected in mid-stream above the intakes of the East London and Southwark and Vauxhall Water Companies at Sunbury and Hampton; and they were considered by Dr. Houston as representative of water which, in a filtered condition, is supplied to the consumers in London. The result of his examination of the samples led him to declare that the Thames at this point is "polluted to a serious extent;" that, in point of fact, the water is simply "sewage diluted about 1000 to 10,000 times." This, of course, is regarding the water from the bacteriological point of view; and a good deal has been made of the statements by those who do not hesitate to decry the London Water Supply. But is it really so bad as Dr. Houston makes out? "Diluted sewage" is an offensive phrase; and it serves a certain purpose. After all, however, when one comes to think of dilution to the extent of 1000 times, to say nothing of this number multiplied by ten, and of the filtration which the liquid would have to undergo before it would be brought within the consumers' reach, a good deal of the alarm to which the words are at first likely to give rise is dispelled. We must confess to a strong belief in the self-purification of water, and in the efficacy of filtration as this process is now carried out by the London Water Companies; and in this we think we are in accord with many of our readers. Condemnatory as Dr. Houston is as a bacteriologist, he has the candour to acknowledge—indeed, he could not do otherwise—that "proper filtration of an impure water is a most valuable security against the spread of water-borne disease." At the same time, he is unable to regard it otherwise than as a relative safeguard. He says it is impossible to state how far the immense scale of the operations of the London Water Companies conceals minor mischief due to water. He urges that a poison may be present in appreciable amount, and yet be so generally and equally spread among the consumers as to have no really deleterious individual effect. We quite agree with this; and we are not prepared to dispute Dr. Houston's statement that objectionable bacteria in water are not always removed in the process of filtration. We contend, however, that those remaining are not so harmful to the human

organism as certain bacteriologists would have the public at large believe.

It is rather singular that Dr. Houston's attack on the London Water Supply should have appeared only a few weeks after the close of the latest of the numerous inquiries into the subject conducted during the past thirty years—inquiries which have thoroughly vindicated the supply from the aspersions cast upon it. The "dilute sewage" of the modern Bacteriologist is only a variant of the "previous "sewage contamination" with which a late eminent Chemist scared a past generation. And yet his later experience enabled him to tell Lord Balfour's Commission of 1892-3 that the raw water of both the Thames and Lea could be transformed into a beverage quite as good, from the point of view of the public health, as deep well water; while a few years later he assured an audience at the Royal Institution that Londoners had every reason for congratulating themselves that they had at their very doors an ample supply of water which, "for palatability, wholesomeness, and general "excellence," was not to be surpassed by any supply in the world. If ever there was an unsparing critic of London water, it was Sir Edward Frankland, the Chemist referred to, at one period of his life; and in view of this fact and of the evidence he had given, the Commissioners expressed the opinion that the allegation which had been made to them, and which they had carefully examined—viz., that the various conditions, and agencies tending to the destruction or the elimination of the pathogenic bacteria during the flow of a river, during the sojourn of the water afterwards in the subsidence tanks, and its subsequent treatment by filtration, were such as to make it extremely doubtful whether one of those bacteria would be found in the water as delivered to the consumer—rested on a very substantial basis. They therefore came to the conclusion that the use of the water then supplied to London would not be likely to cause a spread of disease. This conclusion was fully supported by Lord Llandaff's Commission in 1899; while the Arbitrators who have recently been determining the amounts to be paid by the Metropolitan Water Board for the Companies' undertakings felt bound to hold "that the "waters of the Thames and Lea must be taken as capable "of being supplied in excellent condition for domestic "purposes." This opinion was formed after hearing the evidence of specialists of equal eminence with Dr. Houston, which, we venture to think, carries sufficient weight to effectually dispose of the "dilute sewage" bugbear. We quite believe him when he says there exists an "under par" condition among some of the inhabitants of London; but we cannot agree with his suggestion that it may be attributable to the inferior quality of the water supplied to them. If the quality of London water in 1893 was such as to justify Lord Balfour's Commission in characterizing it as "of a very high standard of excellence and purity, and suit-"able for household purposes," it must necessarily be better at the present time, considering the extensions which have since that date been made in the filtering plant. If it is not considered good enough by those who will in the future have the supply in their hands, the duty will devolve upon them of raising it to their standard.

Checking Municipal Corruption in Massachusetts.—It appears from the last report of the Board of Gas and Electric Light Commissioners of Massachusetts, some figures from which were given in the "JOURNAL" for the 5th inst., that an Act was passed on the 5th of May last year relative to public service corporations and their employees. It is directed against the practice of making the giving of a vote the vehicle for securing the good offices of the party benefiting thereby in obtaining for the giver some position or employment. The Act provides that a fine of not less than $50 or more than $100 shall be imposed "for each offence." Our contemporary the "American Gaslight Journal," referring to the matter, points out, from an experience of ten years in New York, how detrimental "politics" can become to the true interest of working men, who suppose themselves to be benefited by a system where "pull" is required to procure "even the humble privilege of sweeping up a stable, or equally unpretentious and ill-paid labour, not to mention the high rank of a street-car conductor or motorman." The writer thinks that if the Massachusetts law were applied to the State of New York, it would greatly relieve politicians and employers, and contribute in a large degree to at least compulsory self-respect on the part of the labouring men, who at present do not seem to be able to help themselves in any other way than by applying to some noted or notorious politician to "use his influence" in procuring for them the poor privilege of earning a precarious living by very hard work.

THE PRACTICAL USES OF RADIANT ENERGY.

IT is one of the most striking, and at the same time most important, of the uses of scientific discovery, to revive interest in a number of more or less cognate matters, which have been set aside as unintelligible with the aid of the previous knowledge. The observation appears to be justified in regard to the new instance of radium and its analogues, which have awakened fresh curiosity with respect to the phenomena of radiation in all kinds. The phenomena of radiant energy are among the most familiar in the whole realm of physics; yet some of them are by no means easy of comprehension, or of reduction to the accepted mathematics of the subject. Take, for example, artificial lighting and heating. The fact of lighting, is a matter of radiation only. This is the only process by which the effect of lighting is, or can be, produced. What are in common, as well as in poetic, speech called the beams or rays of light, constitute the whole action of the luminant; and experimental science has hitherto failed to detect the smallest fraction of any other. Every student knows that Sir William Crookes once received the impression, from the remarkable movement of his radiometer, that light is ponderable; but this was quickly perceived to be a mistake. Students also know that the new discoveries of bodies peculiarly susceptible to radiant action, whether self-originated or as a reaction, do not contravene the accepted understanding as to the nature of the mechanism of radiation. The law of inverse squares, which is the foundation of photometry, still holds good for the purposes to which it is applied.

Yet the modern revival of questionings on this subject, still fails to penetrate the particular mystery of radiation which possesses a very high practical value—among the highest, indeed. This is, the inadequacy of the law of squares to account for the rapid weakening of radiant force beyond a certain distance which it is comparatively easy to ascertain in practice, although there does not seem to be any theory of it. A familiar illustration of the phenomenon in question is the appearance of a road lighted by public lamps. It might be thought, that according to the law of inverse squares, the effect of lighting by scattered lamps, at considerable distances apart, would be that of brighter points gradually shading off into deeper darkness in the regions most remote from the light-sources. Really, the appearance of a road so lighted, when viewed endwise, is that of a series of bright spots, surrounded and divided from one another by shadowy stretches of the roadway. It is difficult to reconcile the appearance of lighted spots with a law of regularly and rapidly diminishing distribution. It may be suggested that the size of the light-source, or its spectrum, has something to do with the production of the effect in question; but the answer to this is, that the law of inverse squares does not take any account of these considerations. Whether the source of light is a mere point, like the crater of the electric arc or a Nernst lamp viewed endwise, or a large surface like that of a flat-flame gas-burner, does not make any difference in photometry.

It might be said, with some plausibility, that this particular effect of the production of well-defined bright spots in a road lighted by means of scattered lights, is a physiological phenomenon, arising in the eye of the spectator. The unreliability of the unassisted eye to distinguish between relatively large differences of luminous intensity, is noticed in connection with the Westminster tests of street-lamps (see "JOURNAL" for the 15th ult., p. 684). The obvious reply to this observation is, that since the eye must be the ultimate judge of lighting, a photometric measurement which is meaningless to the organ of perception is not of much value. Thus, though the photometer may ascribe a high luminous intensity to a naked electric arc, inasmuch as the eye is incapable of deriving a commensurate degree of perceptivity from a light-source of this form, the instrumental measurement is beside the purpose. But the real question here is, whether this limited range of noticeable radiant effect is due to want of perceptive power on the part of the observer, or is something inherent in radiant action itself. The query suggests another, which is: What becomes of radiant energy that loses itself in the course of transmission? What happens to the light that does not get through a clouded or deep-coloured glass? Nay—more curious inquiry still—why does a ground-glass globe stop so much light? Nothing, in the latter case, has been done to make the glass absorbent of light.

For the further elucidation of these problems, it is desirable to turn to an examination of the other undulatory force, heat, which operates also, but not exclusively, by radiation. The radiation of heat is a phenomenon of very limited range indeed, unless the evolution of heat not only has an elevated initial temperature, but is also of great volume. The intense heat of the electric arc does not radiate much; whereas the radiation of a scarcely luminous oil conflagration, though not attended with so high an elevation of temperature, penetrates to great distances. In the case of town fires, the spreading of the flames is largely due to the preliminary roasting of everything combustible by the radiant heat of the burning buildings. Yet in the industrial applications of heat, the radiant effect is apt to be elusive and disappointing. It is stated that, in the ordinary means of warming rooms by open fires, merely putting a wire guard before the fire sensibly diminishes the quantity of heat sent into the room by the fuel. The same result follows the housing of steam radiators, or hot-water pipes, with wires, or with casing of any kind. The loss of

warming effect from a common nursery fire-guard has been put as high as 10 per cent. of the available duty of the fire. The same observation applies to fire-screens of all kinds. According to the theory, they ought not to arrest the heat of a fire; but they do. What becomes of it?

The consideration now in question has been discussed by the "Engineer" in connection with the heating of boilers. It crops up in regard to the dimensions that should be given to combustion chambers. It also applies to the heating of gas-retort settings. Frederick Siemens taught that all combustion, to be economical, must be complete. This entails the allowance of sufficient room to the flame to burn itself out without contact with any cold surface. That is quite true; and in many cases combustion chambers have been made much larger than formerly, to great advantage. But this is not the whole truth of the matter. Temperature disappears so quickly, in one way and another, that the best effect of heating can only be obtained when the body which it is desired to heat is brought into the place of highest temperature. This requirement is observable in its greatest development in the case of the incandescent gas-mantle and its activating flame. A mantle which fails to fit the zone of highest temperature of the bunsen flame, is of little illuminating value. The same rule applies to a boiler furnace. Unless the radiant heat, as well as the heat of convection and conduction, is properly caught, the result will be waste of fuel. Our contemporary argues that the law of inverse squares is misleading in this connection. In theory, the effect of radiant heat varies inversely as the square of the distance of the hot body from the cold. Consequently, if radiation is strictly proportional to the area as well as to the distance, an enclosing surface should catch all the radiation from a source, irrespective of its distance from it. "Let us suppose that an incandescent cube of one foot is placed inside a box with a capacity of a cubic yard, and surrounded with water on every side. Water will then be evaporated at any given rate. Now let the incandescent cube be placed inside a box double the size of the first, surrounded in the same way with water. Theoretically, just as much water should be evaporated in the second case as in the first. The distance of the water from the hot cube is, it is true, greater; but the heating surface is larger, and in any case the incandescent mass has a fixed quantity of thermal energy to dispose of, and apparently it must go to the water. If not, what becomes of it?" The question is easier asked than answered.

If the theory is applied to the practice of boiler fire-box construction, it indicates that the distance of the sides or the crown from the fire is of no moment. The heat is there. It cannot get away. It radiates along straight lines, which strike the plates. It fills the whole box, however big. But in practice the result is otherwise. The big fire-box does not steam so well as one in which the plates are down close to the fire. True, the latter will smoke badly, owing to the partial extinction of the flame, which also means waste of fuel. But the troublesome fact of practical experience is that the loss of fuel on this account is less than that due to deprivation of the best effect of radiation, which is inseparable from plates close to the fire, and the fuel burning with a long, smoky flame. The case is precisely the same with an Argand gas-flame in the photometer. Here the greatest radiation of light is from a flame just on the verge of smoking, and not from a clean, bright-looking flame. The complaint of the "Engineer" is, therefore, that in boiler engineering the designer is met continuously by conflicting conditions which, taken separately, make for efficiency, but neutralize one another when brought together and applied in practice. Thus the conditions favourable to smokeless combustion, and the economy of fuel in this way, may be inimical to potential efficiency in the main.

Clearly, this incompatability of conditions, involving as an element the disappointing character of the law of inverse squares, is independent of the nature of the mechanism of radiation. It is immaterial whether radiant energy be assumed to operate by the intermediary ether (thus being classified as an undulatory force), or whether the radiation is conceived of as an emanation of corpuscles of the new fashion, called ions. The curious reality with which the engineer has to do is that, apparently, the waves of the ether die out, or the ions lose their velocity, with aggravating rapidity. It is useless to assert that this is not true. The fact is that, in steam engineering, nothing can compensate for nearness of the boiler plate to the hottest fire. Hence one of the difficulties with the water-tube boiler. If the tubes are too far removed from the fire, not much steam will be made; if they are too close to it, then the gases are chilled and smoke results. It is easy to state the conditions of success, but hard to realize them in practice. The happy mean is difficult to find, and still more difficult to keep when found.

One can understand that a theorist would be able to maintain that there is nothing in the foregoing discussion of practical results, whether of lighting or heating, to throw doubt upon the validity of the law of inverse squares, as applying to radiation phenomena. The inferiority of steaming power of a large fire-box, for instance, may be explained without calling this law into question, but rather as confirming it. If the highest temperature on one side of the boiler-plate is desired, this is to be sought for as closely as possible to the source of heat—that is, the burning fuel. The further the plate is removed, the cooler it will be, and the worse it will steam. All that the law of inverse squares does, however, is to assign a numerical expression to the effect of distance. Yet to the practical boiler-maker, whose need of radiant heat conflicts with his desire for the largest possible combustion chamber, there seems to be something wanting to the theory. The same with the lighting engineer, who finds it difficult to reconcile the realities of "spotty" lighting, and the poor diffusive effect of minute light sources, with the radiation theory. In both cases, it is plainly the duty of the designer to keep theory in subjection to practice. If a boiler with a small furnace steams better than a boiler exhibiting the opposite character in this respect, then one of the requirements of a good boiler is supplied. If at the same time the boiler is economical of fuel, and does not smoke; then no consideration of the law of inverse squares is likely to disturb the equanimity of its designer and users. Likewise, the best street lighting is that which is the most serviceable, all things being taken into consideration. If certain light-sources are found not to give so good an effect as others, no theory of radiation will help them. After all, science follows experience far oftener than it anticipates it. In this matter of radiant effects, the whole truth does not seem to have been reduced to that order and system to which the name of Science is conveniently given, without necessarily implying completeness of the category.

ELECTRIC LIGHTING MEMORANDA.

The Principal Financial Points of the Leading London Electric Lighting Companies.—A Forced Comparison.—Electric Light Profits on the Basis of Population.—A Mysterious Electrical Fatality.

THE working results for last year of the principal Metropolitan Electric Lighting Companies furnish the best possible standards for measuring the financial and works' records of the most fortunate undertakings of the kind. One hears so much of what municipal electricity supply can and cannot be done for, that it is comforting to know precisely how the same business is carried on by the best-paying concerns. The St. James's and Pall Mall, and the Westminster Companies, are admittedly in the first rank of such undertakings, if they do not in themselves constitute this select class. The former pay 14½ per cent. and the latter 14 per cent. dividends on their ordinary shares. Their business is not organized on a socialistic basis. The point of saturation has been more nearly approximated to in the former district; whereas the consumption in Westminster is still growing fast. The two Companies are able to generate current locally at a works' cost of about 2¼d. per unit; but they also have a supply in bulk from a Company formed for the purpose, for which they find it worth while to pay 3d. per unit delivered. The total receipts of both Companies from all sources are well below 4½d. per unit. The dividend costs about 1d. per unit; and the allowance for depreciation is in each case about ½d. per unit. These cardinal points, therefore, fix the financial bearing of the electric lighting business in the West-end of London for the year 1903—being the fourteenth of the age of the venture. The circumstance of these two Companies being satisfied to pay after the rate of 3d. per unit for electricity in bulk, to their order, supplied by works of their own providing, and of which they take the profits, is a pretty sharp satire on the offers one hears about of current at 1d. per unit, or thereby. This is for about 2½ million units a year. The reason is that these Companies, having been in the business for 14 years, know what the expenses are. They have, besides, nothing whatever to gain by pursuing a policy of deception. It is no great merit to charge things to their right headings when one is in a position to pay 14½ per cent.

How serious a concern for professed municipalizers is this proof of what it costs the leading Metropolitan Companies to supply electric light, is to be inferred from the way the evidence is wrestled with by the able electrical expert of the "Municipal Journal." He deals with the accounts in a rather funny fashion, so classifying the charges in the case of the Westminster undertaking that he is able to point out that "the depreciation, sinking fund, and debenture charges together amount to only 0·687d. per unit sold, which is about half what would have to be paid by a local authority for interest and repayments." This comparison is very obviously fallacious. The payments of a local authority for interest and sinking fund are the equivalent of company allocations for all capital charges, including the dividend. If the sinking fund of the authority is of the later and heavier order, which is supposed to cover depreciation, then what the authority pays for interest and sinking fund is the exact counterpart of what a company charges to dividend, interest on borrowed capital, depreciation, and reserve. In the particular case of the Westminster Company, which has a capital of a million sterling, in round figures, these charges altogether work out to as nearly as possible 2d. per unit. It is the same in the case of the St. James's and Pall Mall Company. Working expenses and capital charges are about equal. A gross revenue of not much less than 4½d. per unit sold is needed to make these undertakings pay—one with its million capital, the other with about half as much. There is another similar concern of which the same tale may be told. This is the Chelsea Company, with a capital of £450,000. The average price received per unit by this Company last year was 4½d.; which we are told by the municipal critic is "a rate that ought to pay well, in comparison with the local authorities, who have in most cases to be content with something under 4d."

The rejoinder to this observation is that there is no compulsion in the case. If the local authorities choose to charge less for current than the best-managed companies can sell at, it can only be for other than ordinary commercial reasons; and they must do it by living upon their capital, or getting a subsidy from the rates. Current costs the Metropolitan Local Authorities as much for generation as it does the Companies, if not more. With a sinking fund requiring about half the money needed for interest on the loan, the financial obligations of the local authorities are rather heavier than those of a well-to-do company. Therefore, those local authorities who aim at preserving their solvency cannot depart to a very great extent from the cardinal points of companies' working.

A communicated article in the current number of the "Electrical Review" deals with the relation of the profits of municipal electric lighting to population. All the returns of such undertakings available have been classified and analyzed, with the result that certain broad generalizations transpire. The localities are divided into four classes, by population. The first includes all districts up to 25,000, which embraces all the small market towns and residential seaside places. From 25,000 to 50,000 population covers the large county and small manufacturing towns; and all beyond includes the largest seaports and inland manufacturing towns. Three years after starting to supply electricity, these places show a balance of revenue and working expenses; but six years elapse before any of them can pay their interest and sinking fund charges. Anything beyond this, such as adequate depreciation, is to seek. Generally, towns of less than 100,000 inhabitants have made an average loss of 1·1 per cent.; and the larger towns have only been able to set aside the sum of 66s. per £100 towards depreciation of plant and machinery after six years' wear and tear. The average of the smallest towns, in the first class, after six years are working at 62·7 per cent. of expenses to gross receipts. They also require 58 per cent. on the same to pay interest and sinking fund. The towns of the next class work at 59 per cent. of the receipts; and require 46 per cent. to pay the statutory capital charges. The districts of the next class—between 50,000 and 100,000 population—are not so well off. Their working percentage is about the same; but their capital burden is greater. The largest towns work at 50 per cent. of expenses; but their capital charges are only 45 per cent. Consequently they show a small margin of profit.

Another mysterious death attributed to electric shock has occurred, to disturb once more the confidence of those who had begun to think that the terrors of accidental "electrocution" were past. Nothing of the kind had happened since the Fulham baths fatality, when the whole question of how safety is to be assured was raised again by the accident under notice, which occurred on the 28th ult. at the Charing Cross Company's Bow generating station. It appears that the sufferer in this case, a switchboard attendant named George Crates, aged 22, was employed about one o'clock that day in shutting down a section of the plant for repairs. Current is generated at these works "in bulk," at 10,000 volts, on the three-phase system, for transmission to the Company's sub-stations in various parts of the district, where it is transformed to continuous current and distributed in the ordinary way. All the sub-stations having reported that the load was off the particular section, the engines were slowed down, and the volt-meter brought to zero. All being apparently clear, Crates proceeded to remove from the switchboard the fuses of the cables which were supposed to be "dead." These fuses are in heavy glass tubes, with about 8 inches between the end metal fittings. Crates removed six out of nine of these fuses, and was in the act of removing the seventh—apparently the first of the third cable—when there was a report and a flash, and the man fell back with the fuse in his hand. Efforts were made by the other hands to restore respiration, but Crates was dead when the doctor arrived. In the course of the examination at the inquest, the Engineer in charge of the station said the occurrence was inexplicable. The fuses were as completely cut off as was possible, and there could be no accidental contact of the "dead" section with the others. He would have had no hesitation himself in handling them. The only explanation offered to account for the fatality was that possibly the man had held the other fuses by the glass, but in the last instance had touched the metal and received a shock from a static charge in the cable. Some electric engineering authorities accept this explanation, while others are sceptical. In order to make it plausible, it is necessary to assume that a residual charge had somehow accumulated in the cables, and could not leak away in the time. This seems to argue a far higher degree of insulation of the connections than is usually either obtained or expected. It is, of course, easy to be wise after the event; and this is a kind of wisdom in which coroners' juries are especially proficient. In the present case, it is recommended that all the precautions necessary to ensure the safe handling of electrical power plant should be observed; and also that high-tension cables and their connections should always be regarded as sources of potential danger, and be safely earthed before they are touched. These counsels are doubtless sound. But even earth connections have failed before now; and it would seem the more logical conclusion that an uncertain amount of danger must be inseparable from the working of a form of energy proved to be capable of Protean transformations, the fact of which can only be ascertained by actual experience.

STOPS — NOT SLOTS.

THE ADVANTAGES AND DISADVANTAGES CONSIDERED.

(*Concluded from p. 22.*)

Where two systems in which purchase and sale are concerned—such as those we are now considering—are put into the scale with the object of ascertaining which is the preferable, the advantages of that upon which the choice of those falls who have the proprietary right of making the selection, must be, for the system to be eventually successful, well balanced as between the owner and seller and the hirer and purchaser. In this case, the stop-meter, supplemented by the methods practised at Croydon, is held by the Company to be far and away the better system on which to supply gas by prepayment, and to cater for the lighting and heating for cooking purposes of that class of consumers who cannot, or in some instances who though able will not, provide for themselves the necessary appliances for these objects. In discussing one particular phase of the question—that of justice between the gas supplier and the consumer—it is not that section of the prepayment consumers whose individual consumption of gas, under the slot-meter system, does not provide, through the extra charge, sufficient to meet capital charges, maintenance, and the expenses inseparable from the system, who have to be specially considered; it is those consumers whose consumptions extend beyond that limit at which they have fully met all outgoings on their own particular installation. It is shamefully unfair to them that their generous custom of the gas suppliers should go, through their excess ninepences or tenpences or whatever the extra charge may be, towards meeting the costs of those whose consumptions do not contribute sufficient through the extra charge to make their installations considered separately really profitable to the suppliers. And yet, supposing gas suppliers were affected by such a keen appreciation of this injustice to a part of their slot consumers that they returned, say, at the end of a year (to those who had consumed a sufficient quantity of gas to meet, through the excess price, the expenses on their installations) all that they had paid over and above the ordinary price of gas and the required additional contribution from them as slot consumers, the prepayment system, *qua* a distinct department of the gas concern, might in some cases be a thing to be less desired. There is, of course, the profit on the gas consumed; but where the charges are not fully met, the profit on the gas is correspondingly reduced. Thus the correction of the injustice referred to would inflict some amount of injury on the ordinary consumer. However, under the slot-meter system, there is no question that the good consumers do largely support the bad. Of course, the question here—two systems being placed side by side to determine the point of preference—must be considered apart from the profit on the gas consumed.

The Justice as between Consumer and Consumer and Company and Consumer of the Stop System Exemplified.

This question of justice as between prepayment consumer and consumer is one that considerably swayed Mr. Helps and his coadjutor (Mr. Topley) in jointly recommending to their Board the assimilation of the prepayment (slot) system of Carshalton to that as practised in Croydon. Now in Croydon the "Terms and Conditions" of supply published last week have shown readers that for a rent of 2d. per consumer per week a stop meter and a certain number of fittings are furnished. If a cooking-stove is required, an additional rent of (according to type) from 2d. is charged. In the Carshalton district, under the slot system, a cooker has been almost invariably supplied as part of the installation. Therefore, for comparison, we must take a consumer in the Croydon district paying 2d. for fittings and 2d. for a cooker per week. It will thus be seen that he pays in rent twice 8s. 8d. in the year, or a total of 17s. 4d. Therefore, the extra charge in Carshalton under the old slot system being 9d. per 1000 cubic feet, each consumer, to be on a par with a prepayment stop-meter consumer fitted up similarly in the Croydon district, must burn 23,000 cubic feet of gas a year. What, however, is found to be the actual fact? An analysis of the accounts for 1901 of 442 slot-meter consumers in the Carshalton district was made, and may be taken as a guide. Of this 442, only 113 were, it was seen, in excess of the consumption of 23,000 cubic feet which it was necessary for them to burn to bring their payments by way of extra charge for the service on a level with the stop consumers in Croydon fitted up in like manner. The figures (consumptions and consumers) were these—

Under 23,000 Cubic Feet.

Cubic Feet.	Consumers.
8,000	58
12,000	99
16,000	102
20,000	70
	329

Over 23,000 Cubic Feet.

Cubic Feet.	Consumers.
24,000	56
30,000	35
40,000	16
40,000 and above	6
	113

Now where is the fairness as between 57 of the 113 consumers on the right-hand side of this table and the 329 consumers on the left-hand side? Only 56 consumers were paying what was fair to themselves and the Company—taking the Croydon stop meter and fittings and cooker rent as being a fair basis for comparison. The 329 were paying the Company less—the majority consider-

ably less—than a fair return on the capital outlay and the expenses incidental to the system; while 57 consumers were paying more—some considerably more—than in equity they should have paid through their ninepences. Their extra ninepences went a long way towards squaring the outgoings on the prepayment system in the Carshalton district; and that is a state of things not to be compared with the rational and absolutely fair system of prepayment consumers sharing alike those expenses in the manner obtaining under the stop-meter system in Croydon.

But looked at from the Company's point of view, the excess of the 57 did not balance the shortcomings of the 329. Taking the figures given on the left-hand side of the table, a total consumption of 4,684,000 cubic feet is worked out; taking those on the right-hand side of the table, there is a consumption of (roughly) 3,274,000 feet represented. Whereas, taking the 23,000 feet as giving a return at 9d. equivalent to the rent paid by each stop-meter consumer with a cooker in Croydon—viz., 17s. 4d.—the consumption of the 329 consumers should have been 7,567,000 cubic feet, and of the 113 consumers 2,599,000 cubic feet. The 329 consumers were therefore deficient in consumption to the extent of 2,883,000 cubic feet; while the 113 consumers used 675,000 cubic feet more than was needed to give the return from each of 17s. 4d.

	Cubic Feet.		Cubic Feet.
23,000 c. f. × 329 =	7,567,000	23,000 c. f. × 113 =	2,599,000
Actual consumption .	4,684,000	Actual consumption .	3,274,000
Deficiency . . .	2,883,000	Excess	675,000

2,883,000 at 9d. per 1000 Cub. Ft. =	£108	2	3
675,000 at 9d. per 1000 Cub. Ft. =	25	6	3
	£82	16	0

Therefore, the 329 consumers, in their excess charge, paid £108 2s. 3d. less than was really due from them in rent, while the 113 (and 57 especially) contributed to their deficiency—and unfairly there can be no question—£25 6s. 3d. by their excess consumption beyond the standard of 23,000 cubic feet. It will thus be seen that, subtracting the £25 6s. 3d. from the £108 2s. 3d., the Company were short by £82 16s. of the sum they would have received had these 442 consumers been on the stop-meter system as in Croydon; and this, it will be shown, would not have been the Company's only advantage.

It would be too big a matter to investigate what would have been the deficiency, taking the same basis of comparison, if all the prepayment meters in Croydon had also been on the slot system. This, however, is clear: Whether the consumers burn much or little gas on the stop-meter system, the rent of each is the same. The Company, having from him a fixed rent for the fittings, can afford to supply the small and poor consumer; and the large consumer can burn as much gas as he likes—knowing that, in so doing, he is not contributing to the support of the system more than any other consumer, or more than is due from him, and that the gas he is consuming is only being charged out to him at the same price as the gas supplied to consumers on the ordinary system. Thus the stop-meter system as practised at Croydon ensures justice all round; and that justice is now being secured in Carshalton.

An Incentive to Larger Consumptions.

Moreover the stop-meter system on the Croydon lines supplies incentives to larger consumptions. The last point advanced directs us to one. Prepayment gas consumers are not dolts—the fact that they use gas may be taken as evidence proving the contrary. They are, and necessarily so, where their pockets are concerned as intelligent as many of the ordinary class of consumers. But they do not as a rule, it is safe to say, under the slot-meter system, regard the 9d. that they pay in excess of the ordinary consumers, as rent or as (in part) a contribution made essential by the extra labour involved by the system. They, in most cases, lump together the ordinary price and the 9d; and many of them, in consequence, speak and think of gas as a dear article to be sparingly used—in fact, some even look upon it as a luxury in comparison with oil lighting. To the prepayment slot consumer who uses 24,000 or more cubic feet per annum (including a cooker supply), gas does, as a matter of fact, become dear, compared with the gas used by the ordinary consumer. The payment, however, of a fixed rent for a stop-meter and fittings clears away all feeling of a dear article. The payments are looked upon in completely different lights—the rent as that which is due to the Company as the owners of property; the payment for the gas as the purchase price of an article at no more than other folks pay.

As already mentioned, in Carshalton nearly every slot consumer is furnished with a cooker; in Croydon, under the stop-meter system, perhaps not more than 50 per cent. of the consumers hire cookers. It might be imagined that, under these circumstances, the average consumption per consumer would be greater in the former than in the latter. But the facts prove otherwise. They also emphasize this, that the finesse of the gas manager who puts in cookers in every case with an eye to accelerating the individual consumer's consumption, and as a consequence the total, does not always bring its "hen to roost." In numerous instances, the gas consumed in the cookers falls far short of that which is necessary to provide for the charges. Taken all round, the Croydon prepayment consumer may be of a class who would consume rather more gas than the Carshalton consumer; but remember, in considering the figures, that the majority of the Carshalton consumers have cookers, while only about one-half the Croydon consumers have them—the remainder being content with boiling-rings. Yet the average consumption in Croydon, under the stop-meter system, is higher than that in Carshalton under the slot-meter system. Take the average figures for the last two years from all classes of consumers, and the point will strike home.

Average Consumption per Meter.

	Cubic Feet.	Cubic Feet.
YEAR ENDED JUNE, 1902.		
Ordinary—(Croydon)	59,600	
,, (Carshalton)	45,100	
,, (Croydon and Carshalton combined). . . .		57,700
Stop-meter consumers		18,900
Slot-meter consumers.		15,300
YEAR ENDED JUNE, 1903.		
Ordinary—(Croydon)	57,600	
,, (Carshalton)	45,000	
,, (Croydon and Carshalton combined). . . .		55,900
Stop-meter consumers.		18,300
Slot-meter consumers.		14,600

In the circumstance of the absence of a cooker in such a large proportion of the cases in Croydon, there must be a condition of things existing there that causes the average consumption per prepayment consumer to be higher than it has been in Carshalton under the slot-meter system, where, practically without exception, every consumer had a cooker. What is that condition—that incentive to a greater average consumption? Answer fails, excepting that it be the system upon which the stop-meter is worked; the small difference in the ordinary price charged for gas as between Carshalton and Croydon would not account for it. The separate rent for the fittings creates the feeling that the whole of the gas used is as cheap to the prepayment consumer as to the larger ordinary consumer who lives in a bigger house; and this must be an effectual inducement to respectable consumptions. In addition to this, under the slot system, the gas suppliers are limited within very narrow lines—in order to maintain the uniformity demanded in the quantity of gas given for a penny—to the facilities for using gas which can be accorded to a customer. Besides, there is no guarantee as to the quantity of gas a slot-meter consumer will burn; so that a gas supplier cannot afford to put more than a well-defined installation—both in respect of the number and character of the fittings—into any house. This, of course, is a point upon which the insistence of the application of the Prepayment Meter Clauses would impose increased rigour. In the stop-meter system, there is a benign flexibility, which gives the gas suppliers a good range for satisfying every individual requirement, knowing that the extra rent will make the purchase, fixing, and maintenance of the appliances alone, a profitable investment, without counting upon the ultimate produce from the gas consumed. The stop-meter and the fittings, indeed, form a commercial transaction altogether independent of the gas consumption. To this flexibility, credit must be given for a part of the higher average consumption of gas in Croydon as compared with Carshalton.

Capital and Depreciation.

Some of the matters already dealt with were touched upon by Mr. Helps in his Presidential Address to the Institution of Gas Engineers in 1900; but what is now being written may be taken as the result of his and the Company's even more matured experience—an additional four years having elapsed, in which experience has hardened the belief in the stop-meter system as compared with the slot. One matter to which Mr. Helps particularly directed attention was that of the relative capital expenditure per installation; and, though some of the figures are now the same, what he then said in conjunction with them may here be enlarged upon.

The stop-meter system acts as a curb to unprofitable installations, and therefore is a check to unprofitable capital outlay on the part of the gas suppliers. The growing number of prepayment consumers on the slot-meter system is no real criterion as to the success of the system. If the growth diminishes the average consumption per consumer, the average profitable return on the outlay is also on the decline. This does not apply to the stop-meter system—the rent, in this case, providing the return on the meter and fittings without any reference to the consumption. With the slot system, there is a tendency—and this is likely to become more and more pronounced as the system penetrates to the lower levels of the social scale—for people (knowing that the gas suppliers are willing to instal slot-meters and fittings without charge) to apply for an installation, and then burn but little (if any) gas. "The convenience of having gas at their call at no cost to themselves naturally appeals to many people who, if by applying, they rendered themselves liable to the payment even of the small weekly rental which we charge on the prepayment system, would not apply unless they were prepared to burn at least a moderate quantity of gas." This is an extract from the report addressed by Mr. Helps and Mr. Topley to the Board of the Croydon Gas Company, when suggesting the change in Carshalton from the slot to the stop meter system; and it is a logical conclusion. It shows one way in which useless expenditure of capital is saved. Another saving is effected as between the two

districts by, instead of the universal provision of cookers, their installation (at a weekly rent) only where required, and, it follows, where they will be used. Depreciation charges are also saved on the unprofitable installations. In addition, as between a stop-meter and a slot-meter, there is a saving of initial expense to the extent of, roundly, 20 per cent.; and the reduced mechanism in a stop-meter as compared with a slot-meter means less liability to organic troubles, and so a reduced cost in up-keep. It cannot be otherwise.

In giving the comparative capital costs, it must be repeated that a standard installation under the slot-meter system in Carshalton includes a cooker; a standard installation in Croydon (under the 2d. or 3d. weekly rental) does not—it is an addition, paid for separately.

Average Cost of a Stop-Meter Installation (in the Croydon District in 1901).

	£	s.	d.
Cost of service	1	0	0
Meter	1	15	0·9
Main-tap	0	1	7
Fittings	0	13	10·3
Labour, &c.	0	19	3
	£4	9	9·2

Average Cost of a Slot-Meter Installation (in the Carshalton District in 1901.)

	£	s.	d.
Cost of service	1	0	0
Meter	2	2	7·6
Main-tap	0	1	7
Fittings	0	12	9
Labour, &c.	0	14	1·6
Stove	2	8	1·2
Fixing Stove	0	9	3
	£7	8	5·4

The fittings included under the stop-meter system were mentioned in the "Terms and Conditions" of supply previously published (p. 22). It will be seen from the above table that the stove and fixing in Carshalton were responsible for an expenditure of £2 17s. 4d.; and judging from the experience of the requirements in Croydon and the table classifying the total consumptions in Carshalton (see p. 80), which shows 329 consumers burning less gas than the necessary amount to give a fair return (from the excess charge) on the capital and other outlay, there has been a large proportion of those consumers in Carshalton who have not put the cookers to, from the Company's point of view, a profit-compensating use. Yet it would not be fair to charge a slot consumer a separate rent for the stove, seeing that he is already paying 9d. extra for every 1000 cubic feet of gas consumed through it; and the system cannot be complicated by having differential charges according to possible consumption. It was seen by the figures given last week that in Croydon there are 8548 stop-meter consumers. Consider, in conjunction with the above-mentioned cost per cooker, that about 50 per cent. of the 8548 consumers do not require the service of one. The foregoing tables reveal something else. That is the average difference of 7s. 7d. in favour of the initial cost of the stop-meter, which difference is partly spent on the fittings and labour.

Taking next the question of annual depreciation, it is found to be lower to the extent of 1s. 5d. on the stop-meter system per installation of a character comparable with the slot installations in Carshalton; the exact figures for 1902 being as follows:—

	Slot.	Stop.
Amounts required to provide for depreciation charges on meters, stoves (where supplied) and fitting are as follows	13s. 2d.	11s. 9d.
Annual amounts received per consumer in addition to the ordinary price of gas	11s. 2¾d.	12s. 2¾d.

Remembering the figures already quoted, they make manifest the fact that the 11s. 2¾d. was not the amount received per slot consumer, but was made up unfairly by the disproportionate consumptions. However, the figures as they stand show that on the stop-meter system (with cooker) there is a *surplus* of 5½d., and on the slot-meter system a *deficit* of 1s. 11½d.—the difference expressed in terms of per 1000 cubic feet sold being 1·81d. in favour of the stop-meter system. It may be well to reiterate here that in these articles no account is taken of the profit accruing from the gas consumption; the whole idea being a comparison not as between ordinary and prepayment gas supply, but as between two essentially different systems of prepayment.

Cost of Collection.

In all respects, so far, the whole argument, founded on the Croydon experience, has been favourable to the stop-meter system. Now we come to a point which, judged alone from the aspect of cost, is not so favourable. But, truly, the difference is a negligible one when the gains already recounted are taken into calculation. In the case of the stop-meter system, the calls of the collector are weekly; the slot-meter system in Carshalton has only demanded a monthly visit. It follows that the cost of collection, all things being equal, should be greater in the case of the former than the latter; but the difference is far from being four times greater. It is merely a fraction of a penny per 1000 cubic feet, which (without counting the gains already mentioned) must be more than compensated for by the facts that the Company take immediate possession of the money, that there is a weekly check maintained, and that the Company through their officials are brought into weekly contact with the class of consumers that need their assistance perhaps more than any other. The figures as to the cost of collection in 1902 for the stop-meter system (weekly visits) averaged 2·01d. per 1000 cubic feet; for the slot-meter system (monthly calls) 1·86d. In considering these figures, in order that the Company may not suffer by comparison, it should be mentioned that the collections are made by picked men—intelligent and tactful men whose honest work in less remunerative spheres has marked them as fit and trustworthy for the several responsibilities attaching to the office. The Company and the men look upon this work as an outlet to promotion; and the Company deal with it as such from the point of view of pay. Discontent might arise in some other towns if the wages paid were stated; and therefore it will perhaps be preferable to be silent on the point. But it is necessary to bring it into view; and, particularly so, as the figures which Mr. Helps gave in his Presidential Address in 1900 included a lower cost of collection for the stop-meter system—viz., 1·79d., as against 1·86d. for the slot meters—the wages then being some 9s. a week less than now. The difference in the charge for collection, taking all things into account, is considered to be money well spent.

It is, however, found that the collectors on the stop-meter system call on more consumers in a day than can the collectors on the slot-meter system. One collector can visit—take the money, turn on more gas, and enter the state of the meter and the amount of gas to the credit of a consumer on a card—over 120 consumers a day; while in Carshalton—it is true the consumers are somewhat more scattered—if a collector visited (once a month) 70 or 80 slot consumers in a day, it was reckoned that he did well, even with a boy with him to bear the burden of coppers.

An objection to the stop system that may be advanced, as to consumers not having the necessary money when the collector makes his weekly call, is not found to be justified in practice. The regularity of his call makes him an expected visitor, and provision is made accordingly.

A Point against the Stop-Meter System Rebutted by Experience.

It has been charged against the stop-meter system that there is the liability of a consumer being left without gas; while, with a penny in his pocket, there is no such danger with the slot-meter system. That is a very fair point, which only experience can controvert. It would, in fact, be a serious one, were it not for the fact that an intelligent cultivation of a system of meeting any such trouble can be practised anywhere as it has been in Croydon. Recollect there are now close upon 9000 of these meters in the district of the Company; and there will soon be considerably over 10,000 of them. No point can be made, therefore, of a want of sufficient trial. Remember, too, the collectors call on each consumer every week, and, for more than one obvious reason, upon the same day of the week; and his time in the day would alter very little.

When a new consumer is connected up, the first thing the collector finds out is his likely requirement, and advises him accordingly. He ascertains in the first week that the consumer has used (say) 200 cubic feet; and he impresses upon him the value of having a little stock. Experience shows that the consumer realizes this, and acts upon the advice. Then, whenever the stock is trenched upon through any chance circumstance, the collector recommends that the stock should be made up, beyond the ordinary weekly addition. The consumer is not long in learning that there is safety in this. Speaking generally, out of the several thousand stop-meter consumers on the Company's books, they only get (say) from 50 to 60 a week requesting a second call from the collector. Among such a number of consumers as nearly 9000, 50 or 60 cannot be more than the number of those who would in a week find themselves without pence just when wanted if they were being supplied through coin meters.

In Conclusion, and Some Collateral Advantages.

Now the whole of the principal points so far as they presented themselves as the result of the inquiry made of Mr. Helps to ascertain the dominant reasons for making the change in Carshalton from the slot system to the stop system as practised in the Croydon district have been traversed. It has been seen—

(1) That the stop-meter system has not checked the progress of the prepayment business in Croydon so far as it is worth having.
(2) That the stop-meter system ensures fairness as between consumer and consumer.
(3) That the rental system (*plus* prepayment for gas at the ordinary price) ensures a fair return on the Company's outlay, whether the consumption be large or small. In short, "every tub" (represented by an installation) here "stands on its own bottom."
(4) That the system is an incentive to increased consumption.
(5) That there is no unprofitable capital expenditure, and that (partly in consequence of this) the charges, taken as a whole, are lower for the stop-meter system than for the slot-meter system as it was formerly conducted in Carshalton.

There are besides collateral advantages. The risks from the suppliers' point of view are narrowed down to the minimum. The rent and payment for gas is received weekly, and immediately banked to the Company's credit. There is never any question as between the Company and the consumer as to discrepancies between the consumption and the money in the box, as under the slot-meter system. The money being paid directly into the hands of the Company's officials, there are no opportunities for pilferers. Temptation is not present, and a hold is kept (to within seven days) on the consumers, some of whom may belong to that migratory section of the community of every large town. The meter affords a check on everything and everybody—even upon the collectors, though we should be loth to suggest that such a necessity exists in Croydon. There can be no turning on of additional gas without it is detected. The ordinary registering mechanism prevents this. No wrong can be done without it is discovered by someone—by the consumer, collector, or (when the index is taken at the end of the quarter) in the office. The weekly visit narrows down the period of personal control and inspection to as low a point as is reasonably possible. It brings the Company and the consumer into frequent contact; and this is found very advantageous for rectifying anything that may be wrong, and for giving advice such as would not otherwise be sought, if it necessitated a written inquiry or a journey to the Company's office. The slot-meter system in Carshalton was found to be prolific of worrying little points which are unheard of with the stop-meter system in Croydon. There is, for instance, the use of bent coins, and the mechanism getting out of order, and discrepancies between the index and the coin in the box.

Many of these are matters upon which the Company's collectors, who have had experience of both systems, bear testimony. Writes one: "I am sure that the novelty of the slot system is not now in its favour. There is a prevailing idea among 'auto.' consumers that they 'pay through the nose' (as I have heard them put it), and that the Company make more out of them than they do out of the ordinary consumers. It is not popular." The choice of the collectors, too, is distinctly in favour of the stop-meter system. It saves them personally and the consumers no end of worry; no friction or trouble arises over adjustments; and the question of altering meters or returning money on changes being made in the ordinary price of gas are unknown difficulties. Too much cannot be made of this absence of sources of friction in connection with the stop-meter system. It is of supreme importance in securing a permanence of good character for, and friendship towards, a company among prepayment consumers.

There are further conveniencies in the stop-meter system. There are in most districts people who have their own fittings, but who do not wish to incur a quarterly liability—preferring "to pay as they go." Under the slot system, it would be inconvenient to the Company for such consumers to be put on any other terms than those applying to the ordinary slot consumer. But, with the stop-meter system in Croydon, for a penny a week those consumers can have a meter, and the advantage of not running up an account for gas. A further consideration is that there are always a certain number of cases where a manager is doubtful about giving credit, and yet he hesitates to create friction by insisting on a deposit, though within his legal right. Such consumers are found to welcome the stop-meter (where they would not entertain the slot meter) as an alternative to a deposit and the ordinary system; and the Company are safeguarded. Again, instances are found where a man (who has previously been unfortunate in business, or for some other reason has not been able to pay his quarterly account) will, on seeking to renew his custom with the Company, have a stop-meter for his new supply, and pay off his old indebtedness to the Company by weekly instalments. This is infinitely better than having recourse to legal process to recover the money. In connection with the stop-meter system in Croydon, we are assured that litigation is a rarity; the machinery is so elastic, and so defensive of the Company's interests.

It is interesting to learn that the change in Carshalton is meeting with every success. It will take a little time to complete it. Several of the consumers who understood, or who had knowledge of the Croydon system, immediately applied to have the change made. It is now advertising itself, and bringing in the applications faster than the Company can deal with them. An installation in one house of the stop-meter has a sharp influence. The neighbours hear that by it gas is being obtained at the ordinary price—2d., 3d., or 4d. per week (as the case may be) covering all the excess charge that the slot-meter formerly carried; and they want gas on the same terms. There is besides a sentimentalism which runs deeper and deeper as descent is made in the social scale (until, of course, the level is reached where respectability has no meaning or existence), and which cries out against anything which seemingly creates a class distinction, even if the distinction is made for the benefit of those who look upon it as a cause for grievance. The slot-meter system in most places is tolerated by those who take advantage of it as being for them the exclusive convenient means to a desirable end—the obtaining of a supply of gas on easy terms; they have no knowledge of any alternative system. In Croydon, the stop-meter is regarded as being a nearer approach than the penny-in-the-slot meter to the system on which people in better circumstances procure their gas supply; and there are consumers in Carshalton who welcome the change alone for the escape it affords from the confession of buying gas a pennyworth at a time. It wipes out a class distinction. This may be a small point; but it is not the less real in the experiences connected with the making of the change.

These articles constitute the argument for the change from slot meters in Carshalton to the stop-meter system as in Croydon. But after all that has been said, we do not think that Mr. Helps will claim that he has in the latter a perfection above any other system of prepayment for gas that time may give birth to. All he claims is that, from his experience of the two present systems side by side over a long course of years, he has the acme in the stop-meter system. Nor does he suggest the possibility at this time of day of the overthrow of the slot-meter system in favour of his own preference. His consent (on solicitation) to have the experiences of the Company stated in the full manner in which they have been treated here was given in order that, if there is any value in them for others, they may take advantage of it. For supplying the groundwork for these articles, we are not less thankful to him than will be most of our readers, who recognize to-day what was not recognized so profoundly a few years ago, that the sale of gas demands study and attention equal to that given to its making; and therefore all that is to be known from actual experiences in that respect should be known and be well-considered. Here we have presented from Croydon experiences that are almost unique—in large degree, the qualification is unnecessary. Who will say that the change from "slots" to "stops" in Carshalton is not justified?

EMPLOYMENT OF WATER GAS IN FRANCE.

In a recent issue of "Le Gaz," additional evidence was afforded that the prejudice against the use of water gas as an auxiliary to coal gas manufacture is gradually being overcome in France. Some of the credit for this is certainly due to M. Jouanne, the Technical Editor of our French contemporary, who has been unceasing in his endeavours to bring out the advantages of this gas, and dispel the alarm with which its admixture with coal gas was viewed on his side of the Channel. He has the satisfaction of finding that his labours have not been altogether in vain, as a number of Municipalities have not hesitated to allow their concessionaires to employ a mixture of the two gases.

It appears that Beaune was the first town to break down the prejudice; and when, a few years ago, the gas-works were placed in the hands of a lessee, the lease contained a clause that he should be at liberty to put a certain percentage of water gas into his coal gas. More recently, when the Municipality of Nantes granted the European Gas Company an extension of their concession for twenty years, it was stipulated that if at any future time it should be deemed advisable to sanction the manufacture of water gas, it was to be regarded in the light of a new process, which would justify the Municipality in claiming a reduction in price in proportion to the economy realized. On the renewal of the concession to the Bordeaux Gas Company in June last year, the nature of the gas to be supplied was defined in the contract as "suitable for lighting, heating, the production of power, and all other uses;" and the Company were not restricted to gas made from coal, but were to be at liberty to supply "any other gas or mixture of gases capable of rendering the same service." On the renewal, not long ago, of the contract between the Municipality of Chartres and the Compagnie Centrale, authority was given to the latter to employ carburetted water gas to the extent of 30 per cent. of the bulk of the coal gas supplied.

The foregoing are provincial towns; but in the capital itself there is evidence of a changed attitude towards water gas. When the new contract was made for the supply of Courbevoie in 1899, the Prefect of the Seine, M. de Selves, sanctioned a clause permitting the use of this or oil gas, for the purposes of light, heat, or motive power. In the contracts recently entered into with the communes in the suburbs of Paris, to provide for a continuance of the lighting arrangements after the expiration of the Paris Gas Company's concession, the use of a mixture of coal gas and water gas is authorized. The reason for this was explained by M. Defrance, Director of Departmental Affairs, at a meeting of the St. Denis Communal Council a few months ago. He stated, in answer to a question put by a member, that they had not previously ventured to authorize the employment of water gas. But it was utilized in London and in Brussels mixed in the proportions of 25 to 30 per cent. with coal gas; and it had not caused a single accident. In the South of France, the use of carburetted water gas with coal gas to the extent of not more than 50 per cent. has been sanctioned at Nice, provided the same illuminating power is kept up; and if any economy results, the Municipality and the private consumers are to participate to the extent of half of it. In regard to this authorization, the Deputy-Mayor (M. Isnard) explained that it had been given because the Commissions which had investigated the subject in Paris and Marseilles had expressed a favourable opinion on carburetted water gas, which, moreover, was employed in most of the large gas-works in England. These examples seem to indicate the existence of a growing appreciation of the advantages of an auxiliary to coal gas manufacture which can be rapidly brought into use in case of emergency, or employed as a permanent portion of the plant.

THE FIRST VERTICAL RETORT-SETTING AT THE EXETER GAS-WORKS.

THE two photographs which are given here will have an exceptional attraction for the gas profession, being, as they are, views of the first setting of six vertical retorts at the Exeter Gas-Works on the Settle-Padfield system. The completion of the setting is particularly welcome, as it assures all who are interested that the time cannot be far distant before they will have possession of actual working data—true, still on a small scale, which will hardly give satisfactory evidence on the point as to the amount of labour that will be required on a large number of settings. Those who have studied the matter, who have seen the smooth manner in which the charging goes on mechanically, with nothing more than an occasional inspection by the man in charge, cannot be otherwise than impressed by the fact that the labour on an extensive installation will be down at an extremely low point. But it is for the manufacturing results of this setting that engineers are waiting. It seems to be forgotten, though pronounced reference was made to the matter in the article on Jan. 12 last, that all the figures published up to then were from a single experimental retort which and its setting had been merely built up from odds and ends in a crude fashion. There is nothing crude about the present setting of six retorts. It has been constructed on lines equal to any ordinary permanent setting; and if all parts have been designed and executed in suitable proportion, the results should be absolutely dependable, and (we repeat once more) on a scale exceeding those obtained by the crude experimental retort. On the experience gained, in the construction of this setting, future work will be designed. Already it is found that the setting can be drawn in closer, so as to occupy even less space than the one illustrated; and other improvements have been brought to light by it.

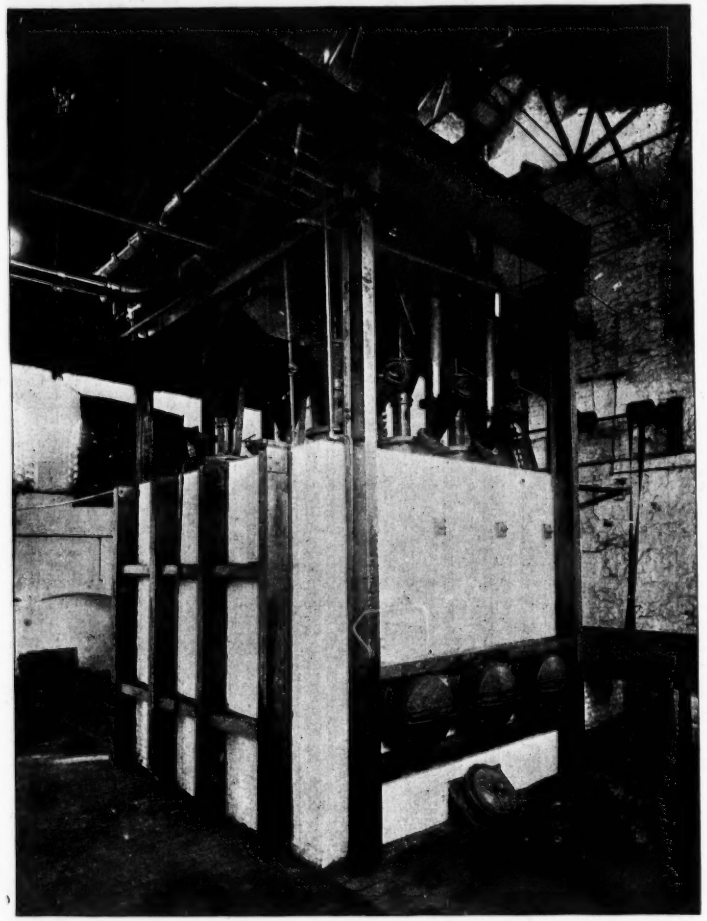


FIG. 1.—FRONT AND SIDE VIEW OF THE SETTLE-PADFIELD VERTICAL RETORT SETTING AT EXETER.

We have no special description of the setting to give beyond the brief one incorporated in the article published on Jan. 12 last, from which the following is an extract:—

> As to the new bed of six retorts that has been constructed at one end of one of the old horizontal retort-houses, it is very complete and compact, and contains six circular retorts (three on either side), of 1 ft. 4 in. top diameter, expanding to 1 ft. 9 in. at the bottom. The vertical portion of the retort, which is in one length, is 3 ft. 6 in. long, and the inside measurement of the curved and inclined discharge end (formed of four segmental ring-pieces) is 4 ft. 9 in. —making the length throughout 8 ft. 3 in. The furnace is on one side of the bed only. The coal is to be elevated to overhead hoppers; and these will feed into the conical hoppers for the supply of the plungers through shoots which will be sealed by the coal in the latter. In every respect, the working will be as already described in dealing with the experimental retort. But all the crudity that is present in the latter has been banished; and there is an air of completeness, excellence, and permanence about the whole of the work. It is from the experience with this setting that the perfecting of the structural details will be accomplished. The house in which the bed stands is 55 ft. 4 in. wide; and at the other end there is an old horizontal bench of 20 feet retorts. Now in the place of one central bench, it would be possible to get into the house two benches of vertical retorts of six in a bed—each bed being 10 ft. 9 in. by 8 ft. 6 in. centres. The reason that two benches would be possible is simply due to the fact that no large amount of room is required as ordinarily for the charging and drawing operations—the former being done mechanically on the top of the bench, and the latter by gravitation. The 55 ft. 4 in. wide house would be divided in this way: Two benches 10 ft. 9 in. each, a centre space of 13 ft. 10 in., and a

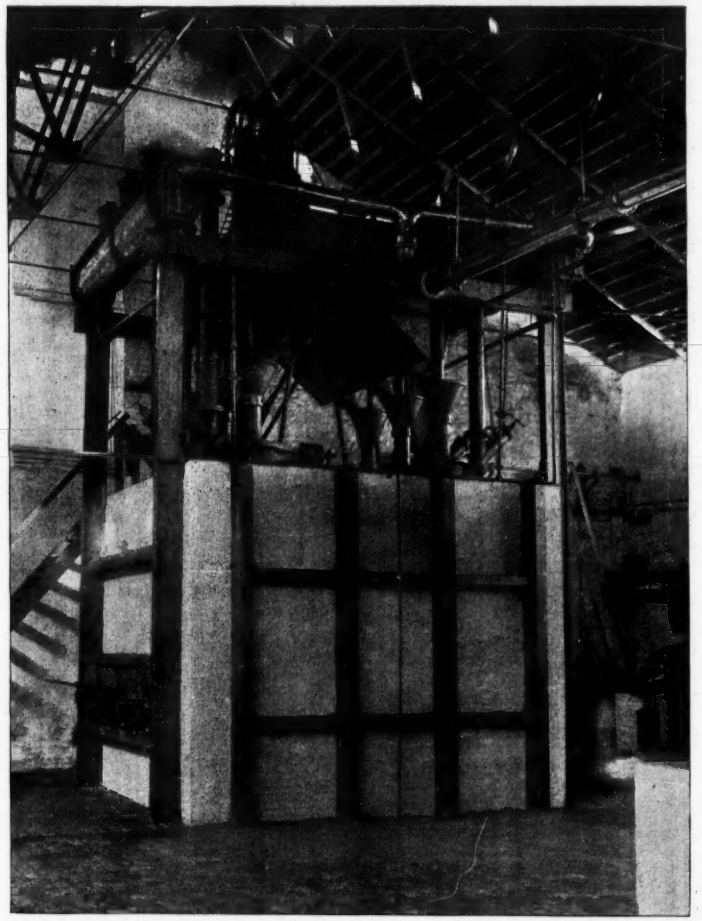


FIG. 2.—SIDE AND BACK VIEW OF THE SETTING.

space between the benches and each side wall 10 ft. wide. With two retort-benches arranged in this way, it might be possible to work both benches from a single continuous hopper running overhead between them with shoots leading on either side to the whole of the conical feeding hoppers. This would mean, in addition, that one elevator and one overhead conveyor would suffice.

In fig. 1, the mouthpieces of the three front retorts are seen, as well as the feeding-door to the furnace. In fig. 2 the mouthpieces of the three back retorts are shown; and, in this instance, a better view is obtained of the feeding arrangements. The head of the coal-elevator will be observed, which supplies the central storage hopper with the W-shaped bottom. This hopper in turn discharges into the two sets of three conical hoppers, at the bottoms of which the plungers work which send the coal regularly into the retorts in modest doses of a few pounds weight. On the right-hand side of the picture will be noticed the small engine and shafting which work the plungers. For a general description of the system, readers must be referred to previous articles on the subject.

PERSONAL.

Mr. J. L. Barraclough, of the fitting department of the Elland-cum-Greetland Gas Company, has been chosen to fill the position of Manager of the Royston Gas Company.

Mr. John Bond, the new Gas Engineer and Manager to the Southport Corporation, formally took over the management last Thursday, when he was introduced to the members of the staff by Mr. E. Trounson, the Chairman of the Gas Committee.

Mr. J. W. Bottomley, the Chief Clerk in the office of the Elland-cum-Greetland Gas Company, has been appointed Secretary and Manager to the Milnrow Gas Company, in succession to Mr. R. H. Nuttall, who, as already announced, has gone to Marsden.

Mr. E. W. H. Eady, who has for some years been Accountant to the Southampton Gas Company, has been selected by the Directors to fill the position of Secretary, lately vacated by Mr. C. Crowther Smith, who, as already mentioned in the "Journal," has been elected a member of the Board. There were 96 applications for the post, in response to the invitation in our advertisement columns.

The position of Secretary of the Reading Gas Company (rendered vacant by the much lamented death of Mr. A. H. Cane) has been conferred upon Mr. A. Canning Williams, the Accountant of the Scarborough Gas Company. Mr. Williams entered the service of the Blackpool Corporation as Clerk in the Gas Department in 1882; and in 1888 obtained a post with the Scarborough Gas Company, being promoted in 1895 to the office which he will shortly vacate. The Directors of the Reading Company have promoted Mr. J. R. H. Jacobs (who was Chief Clerk to Mr. Cane) to the post of Assistant-Secretary.

At a recent meeting of the Directors of the Company, the resignation of Mr. J. H. Cornish of the position of Secretary and Manager of the Bridgwater Gas-Works (after a period of service extending over 45 years), was accepted with great regret; and an earnest hope was expressed that he might live long to enjoy the well-deserved retiring allowance which was granted him. Mr. Cornish, whose resignation is caused by advancing years, entered the profession at the Taunton Gas-Works, under the late Mr. Thomas Fisher; and during the time he has been at Bridgwater the make of gas has doubled itself over and over again, while the Company have always been most prosperous. Under the circumstances, it is only natural that he should have earned the fullest confidence and esteem of the shareholders and the public generally, with whom we echo the wish that he may be long spared in health to enjoy his leisure. At a subsequent meeting of the Directors, it was unanimously resolved to appoint Mr. Hughes Cornish, of Bridport (seventh son of Mr. J. H. Cornish), to the vacant position. Mr. H. Cornish started his business career under his father at the Bridgwater Gas-Works, where he remained for about 4½ years, leaving to enter the employ of an Electric Lighting Company. For three years he remained with this firm, gaining a useful experience in electric lighting practice all over this country and in America. After this, he spent two years as draughtsman in the employ of Messrs. Edward Cockey and Sons, of Frome, where he obtained a very valuable insight into the design and construction of gas apparatus. Mr. Cornish left Frome to take up his present position as Secretary and Manager of the Bridport Gas-Works, which he has held for the past nine years. During this time, the works have been largely remodelled. Capital offices and fittings show-rooms have been built in accordance with Mr. Cornish's designs; the retort-house has been completely rebuilt on the regenerative system; a new boiler and boiler house have been put up; and a new exhauster, tar-extractor, and rotary washer have been added to the plant. The works are therefore well up to date. Mr. Hughes Cornish is a Silver Medallist of the City and Guilds of London Institute, in Gas Manufacture, and holds their first-class honours grade certificate. He has also several South Kensington science and art certificates. The make of gas at Bridport has increased by about 40 per cent. during his tenure of office, and is now a little over 23 million cubic feet. The output at Bridgwater is 70 millions.

PRESENTATION TO MR. JOHN BOND.

The new Gas Engineer and Manager of the Southport Corporation, Mr. John Bond, was recently the recipient of a solid silver tea service, the gift of the employees at the New Wortley Gas-Works, on his leaving Leeds to take up the position he has obtained. Mr. W. H. Marson introduced Mr. Jessop, who said it was with mixed feelings of pleasure and sorrow that he spoke—sorrow because they were going to lose Mr. Bond, and pleasure at knowing that he had risen still another rung on the ladder of gas-engineering fame. He could honestly say that Mr. Bond had thoroughly satisfied the Gas Committee of the Corporation; he had also satisfied the public; and last, but not least, he had satisfied the workmen. This was shown by the present they were making him, and by the large attendance. Whatever had been suggested with regard to conducting the gas-works, had always been most carefully considered by Mr. Bond; and anything connected with the betterment of the conditions of the workmen was always sure of his support and sympathy. Mr. D. Ralph (truck-weighman) and Mr. Ellis (machine-man) endorsed these remarks. Mr. Senior, in making the presentation on behalf of the employees, said they asked Mr. Bond to accept the service as a token of the great respect and esteem in which they all held him; and they sincerely trusted he would have the best of health and prosperity in his new position. Mr. Bond, in acknowledging the gift, said it was with great joy that he accepted it, yet at the same time he could assure them that it was with much sorrow that he was leaving them; for it was not easy to break the relationship that had existed so long between them. He had been with them for 7½ years, and he could say that he had never worked with a truer, better set of men. He had tried to do what was right to all parties; and it afforded him great pleasure to see that he had been successful. He availed himself of the opportunity of thanking them all for the interest they had taken in their work; and he expressed the wish that they would show the same regard to his successor.

SECOND PRESENTATION TO MR. J. BOOTH.

An interesting ceremony took place at the Gas Offices, Southport, on the 4th inst.; the occasion being the presentation of a silver tea service by the employees at the gas-works of the Corporation to Mr. John Booth, to mark the closing of his connection with the undertaking as Engineer and Manager. It bore the following inscription:—

> Presented to John Booth, Esq., on his retirement, after 25 years' service as Gas Engineer, from the Southport Corporation, by his workmen. April, 1904.

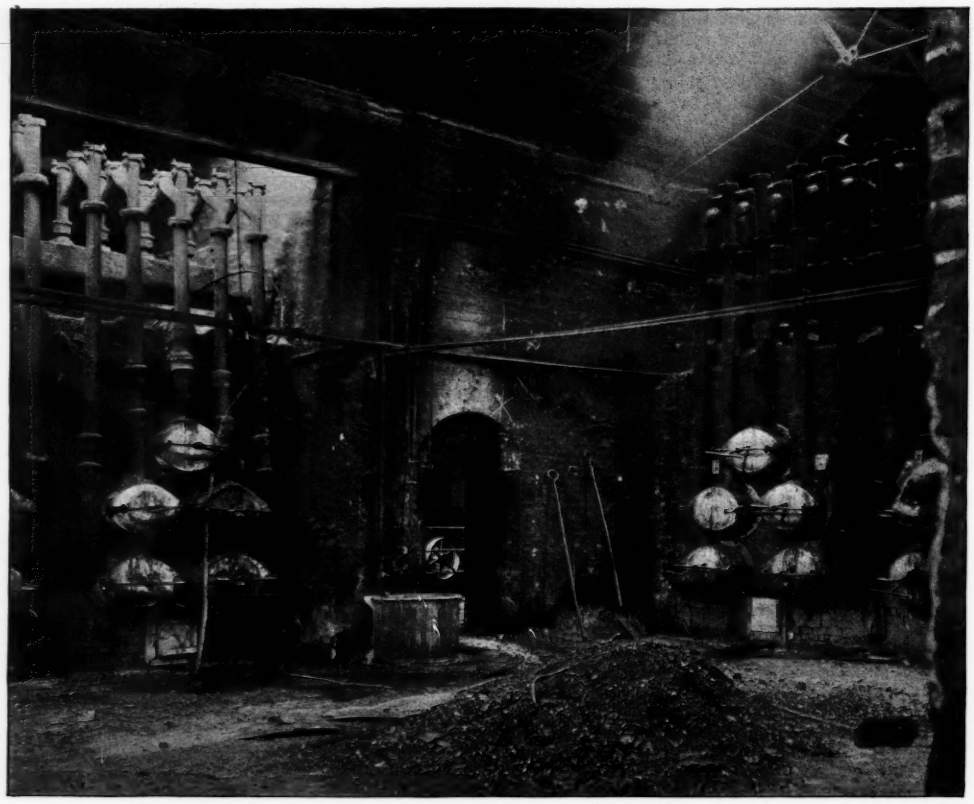
Mr. John Lawton, in making the presentation, said the long connection many of them had had with Mr. Booth in his official position at the gas-works, and the fair treatment they had always received at his hands, made it impossible for them not to feel deep regret at his leaving. During his connection with the gas-works, he had always been an exemplary Manager; and all who had worked under him had had the pleasantest relations with him, and esteemed him highly. He had the good wishes of all in his retirement; and they hoped that he and Mrs. Booth and the family would be long spared, and have a happy future before them. Other speakers joined in these expressions of appreciation and esteem. Mr. Booth, in acknowledgment, thanked them all heartily for the handsome present they had handed to him, and very much more for the kindly manner in which they had spoken of him. From the time when he first came among them, he had endeavoured to do right, and he felt that he had been on the best terms with the workmen. He regretted that the time had arrived when his long and pleasant association with them would cease. The parting was not easy to bear; and he felt it very acutely. In conclusion, he wished them all success and happiness in the future.

Cost of Insuring under the Workmen's Compensation Act.—In an article which appeared in "The Times" on Monday last week, a table was given showing the present and past cost of insuring under the Workmen's Compensation Act. The rates given are the premiums per £100 of the wages bill. For ordinary corporation servants, exclusive of employees engaged in electric or gas lighting, the rate before 1898 was 1s. 6d.; the present rate for the full indemnity is 7s. 6d.; and for legal indemnity, 2s. 6d.—the former competitive rate for this being the same. For gas workers, the old rate was 2s.; the present rate for full indemnity is 10s. 6d.; and for legal indemnity, 10s.—the former competitive rate being 5s. The table shows that the rates which it is now found necesssary to charge are very much higher than was anticipated when the Bill was in progress through the House of Commons. The competitive rates have resulted in very serious loss to the companies who were sanguine enough to adopt them. It is stated that the average cost of compensation is increasing, but that the clause of the Act giving no compensation for injuries causing less than 14 days' disablement has proved a great safeguard against unfair claims. If this clause is abolished, it is estimated that the premiums will have to be raised at least 50 per cent.

BRENTWOOD GAS-WORKS: AS THEY WERE AND AS THEY ARE.

Congested, ill-designed, and structurally impaired beyond any hope of a useful existence hereafter, describe very fairly the condition of certain of the principal parts of the Brentwood Gas-Works when Mr. Robert M. Couper was selected for the position of Engineer and Manager in 1900. The business at the time was making satisfactory progress. The consumption of gas was something like 44 million cubic feet in that year. The prospects of development, too, were excellent; and the reading of those prospects then is, so far, abundantly justified by the one fact that the end of the current year will, there is no doubt, see a total consumption of 70 million cubic feet registered. But the old retort-benches, nursed and pushed so far as their old rickety carcasses and cracked insides would allow, would only produce some 52 million cubic feet a year. It was a good thing for the Company that their new retort-house was ready for work last October. The old site was fully occupied; there being but a small triangular piece of land available upon which extensions could be made. But the location of the old plant was such that, for any real serviceable purpose in the way of extending the producing plant, it was next to useless. Therefore, prospects, congested condition of plant, and its dilapidated character warranted—nay compelled—that a vigorous and no narrow-minded policy should be adopted to save the Company's interests from injury, and to place them in a strong position for the future. It will stand to the lasting credit of the present Directors that four years ago they at once put their confidence in their new Engineer, whose first duty it was to unhesitatingly condemn the old works and to advocate the construction of entirely new ones. This has been done, with the exception of some of the smaller sections of plant; and the scheme so far completed is the principal subject of this article.

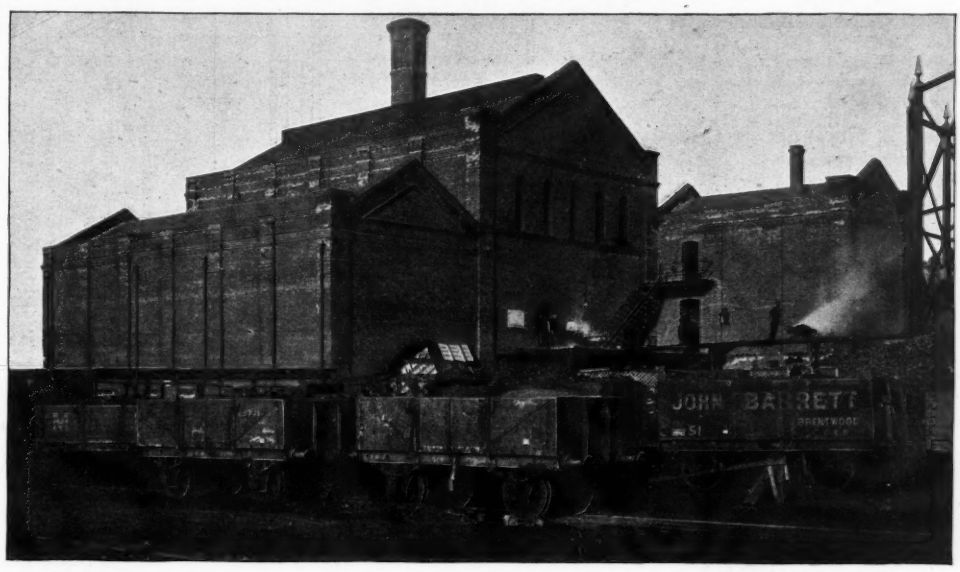
Before taking the new works in hand, the old ones may be briefly described, in order to show their general character. It has before been a circumstance upon which remark has been made, that the builders, or rather the designers, of old had a very poor notion as to the position that gas supply would attain as a necessity in every community. Brentwood is a case in point. As a walk is taken through the old works, the contracted view of whoever originally planned them is brought strikingly to notice. The main idea seemed to be to squeeze on to an ill-shapen site as many buildings and as much apparatus as possible, so that the part of the works—the retort-houses—in and about which there should have been plenty of room for free locomotion in carrying on the operations, should be hemmed in as much as possible.



A Corner in the Old Retort-House—An Ancient Type of Setting.

Yet the last house was only the work of some twenty years ago. The retort plant, as it has latterly stood in the principal house, was unique in one respect. Anyway, nothing similar to it has come specially under notice before. It was, the present remains of the benches show the visitor, a quaintly arranged place. As required, three beds at a time were constructed in what happened to be any convenient quarter of the house, with the result that, in the end, the oblong building contained a bench of three settings on each of three sides. Badly ventilated and badly lighted, and of circumscribed area, one can imagine the torturing conditions of the working life in this house, with fires in front of the men, fires to the right of them, and fires to the left of them, on a muggy winter's day. But the arrangement of the settings was no less interesting than their composition. Five short single retorts in a small arch, and under direct firing, constituted the system on which nine of the settings were arranged, and there was a further three beds of sevens. Their fittings, too, were of a varied and ancient description, as an inspection of the photograph of one corner of the old place will show. Even between bed and bed in the same short bench, variations are discernible. The picture is worth putting on record as an illustration of a past day in retort-house construction compared with the present, and what may be the advance in the future. There were three chimneys dotted about the place, also of an antiquated and insufficient kind. The old exhausters were of the Gwynne type, of only 15,000 and 20,000 cubic feet capacity; two small boilers were of the Cornish make. There is also a set of four purifiers, 14 feet square; and a scrubber and Livesey washer. The condensers are of the annular type; and they, like the purifying plant, are still in use in connection with the new works. The time will come, however—their inspection makes it plain—when it will be imperative for these portions of the plant to be renewed on a more adequate scale. The scheme contemplates these as well as other things as work for the future.

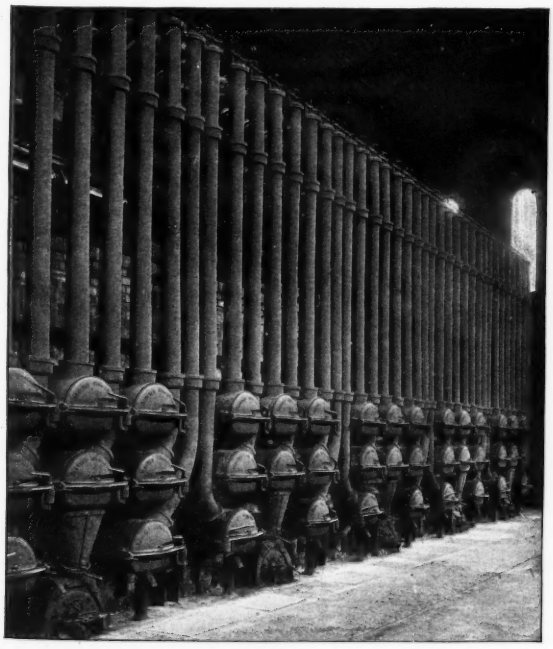
In respect of gas storage, the position was perilous. There were at one time two small holders, each of 40,000 cubic feet capacity, and a larger one, erected about twelve years ago, equal to 100,000 cubic feet; so that there was a total storage of 180,000 cubic feet. The maximum day's output, however, was about 280,000 cubic feet; while the make that could be relied upon was only equal to 250,000 cubic feet. In the two winters preceding that from which we have just emerged, work at Brentwood must have been carried on under great stress; and it is easy to fancy, on a succession of dark days, the Manager anxiously watching the descent of his holders to close upon the last rivets. One of the old holder tanks has now been converted into an ammoniacal liquor tank; while the other holders will continue to supplement the fine new one to be described later in the article.



A General View of the New Works from the Railway.

The plan shows the relation of the old to the new site. It also emphasizes the cramped state of the former. In turning, on his arrival at Brentwood, immediate attention to the position and condition of the works, and seeing how necessary it was that new works should be built, both in the best interests of the Company and in those of the town, Mr. Couper advised that the proper course for the Company was, in the first place, to secure possession of a suitable adjoining piece of land, which had been a brickfield. It had several advantages. It would bring within one boundary the old and the new works, and enable such of the plant as was serviceable to be continued in use without removal until such times as their replacement was opportune or unavoidable. Moreover, the old works were connected to the Great Eastern Railway Company's system by a siding, and so was the brickfield, as is seen by the plan. And, again, the area of the new site was found to be sufficient for accommodating a works equal to a million cubic feet per diem. Therefore, everything was favourable to the proposition that this land should be purchased; and purchase it the Directors did—though that is obvious in view of the near completion of the works.

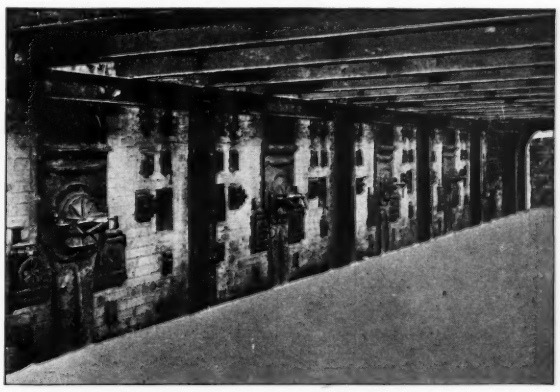
The only objectionable feature about the site was the divergent levels, which dominated considerably the buildings and the general scheme, and which necessitated under each building a good deal of heavy work in levelling up. The different levels have been skilfully brought into use in planning out the scheme. The new works so far comprise one large main block of buildings, a gasholder, and a station-meter house, and sundry smaller work.



In the New Retort-House.

The block of buildings consists of the retort-house; and on the near side to the railway the coal-store, and on the farther side, another house which in its lower part contains separate rooms for boilers, exhausters and other machinery, and the men's mess-rooms above. The arrangement of the buildings is seen from the drawings, and the general photographic view.

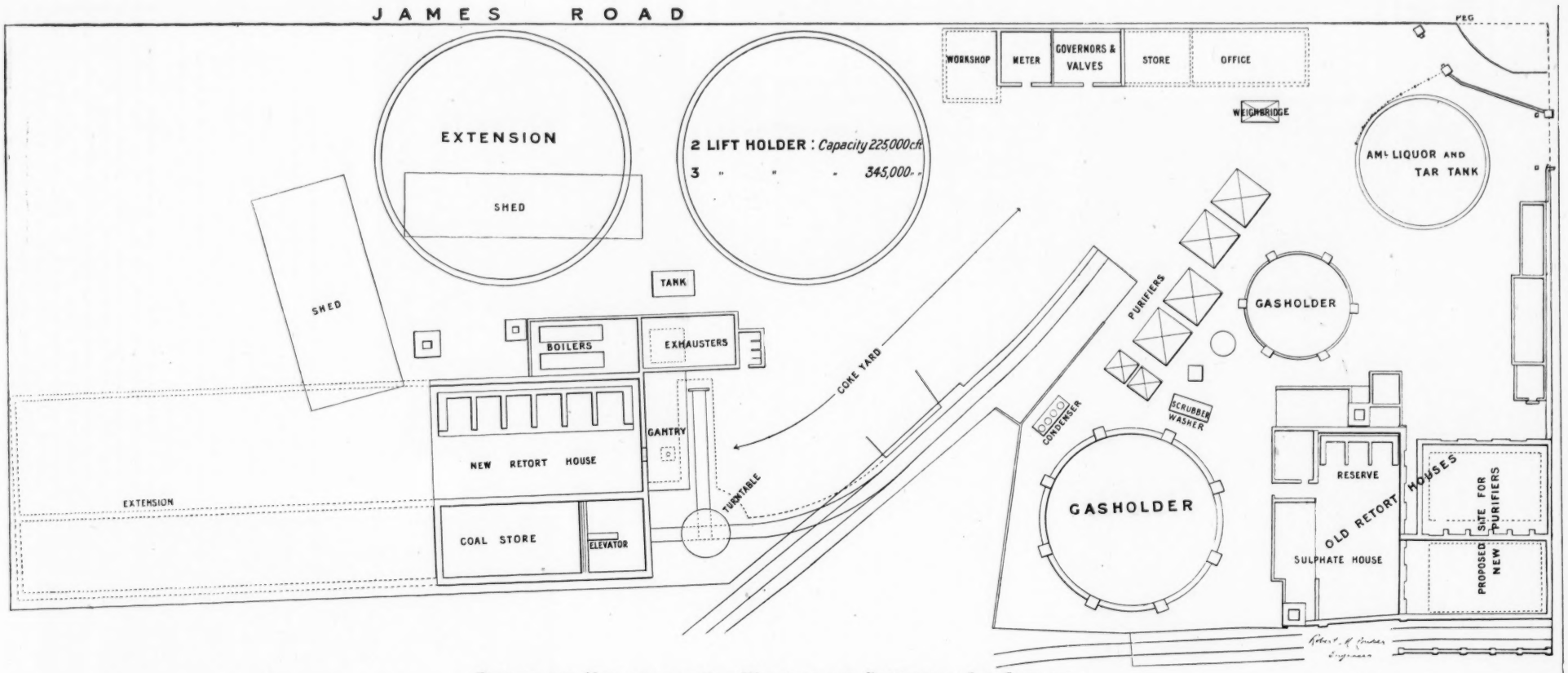
The laying out of the foundations commenced on June 26, 1902, which it may be remembered was the King's originally appointed Coronation Day. The buildings were erected by Mr. Silas Parmenter, of Brentwood and Braintree; and (as part of the same contract) the ironwork of the roofs was supplied by the Crittal Manufacturing Company. The retort-house is 72 feet long by 40 feet wide; and the height of the side walls is 38 feet from the ground floor to the guttering of the roof—the parapets being continued another 3 feet above. The ground outside is plotted out with the view, as necessity arises, of continuing the house in two other sections of equal dimensions, so that when, if ever, that occurs, the house will be 216 feet in length, and capable of containing eighteen beds of retorts. With this in prospect, the



View of the Basement of the New Retort-House.

gable end of the house facing the vacant ground has only been temporarily filled in with galvanized iron sheeting. With the unknown needs of the future before him, Mr. Couper has planned so that almost anything that may happen is provided for without alteration of the width and height of the building. Inclined retorts may be preferred some day; and the building is of sufficient height. When the next section of the house is built, power machinery may be required; so the stage-floor is of ample width for it—being some 22 feet from the front of the mouthpieces to the side wall.

The whole of the buildings are uniform in their architectural features. They are of red brick, relieved by Staffordshire blue brick, bull-nosed on all corners. There is frequent provision in the walls of the retort-house for light and ventilation. The roof is of plain but good type; being merely built up of twelve main principals (6 feet apart), 4 in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. T-steel, with struts and uprights, &c., of 4 in. by $\frac{1}{2}$ in. flat steel. The whole is slated. Along the apex of the roof runs a box ventilator. The stage-floor is 8 feet above the level of the concreted basement floor; and it is constructed of a framing of iron joisting and



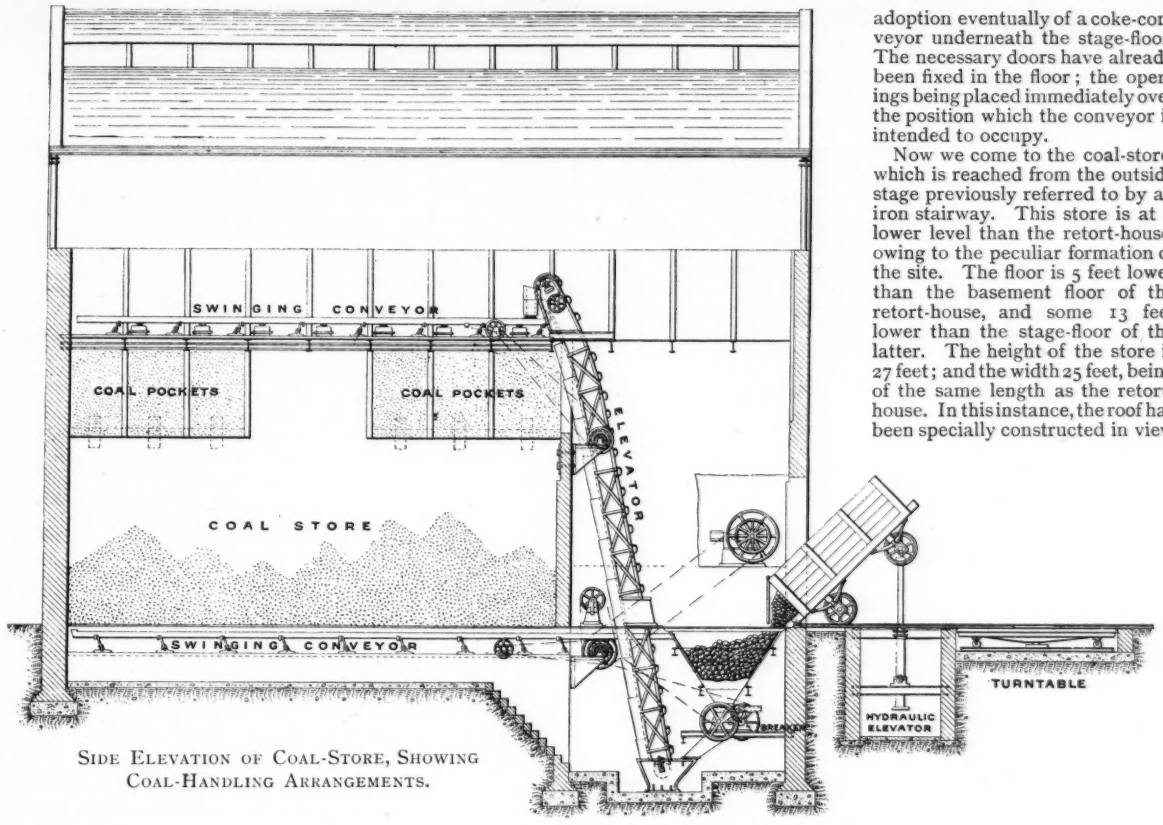
PLAN OF THE NEW AND THE OLD WORKS OF THE BRENTWOOD GAS COMPANY.

brick arches turned and covered with blue Staffordshire chequer-bricks. The retort-bench consists of six beds of eight retorts in each, 22 in. by 16 in. by 10 feet long. The settings are of Hislop's deep regenerative type; and, when that is said, it is a sufficient description and an ample guarantee as to the strength and quality of the work put into them. All the bench ironwork was included in Messrs. Hislop's contract. The mouthpieces are of the Tangye make; the ascension-pipes are 7 to 6 inch; and the other parts of the connections are of a good and sufficient type and dimensions. The foul main (which is carried round the wall of the house) is composed of 180 feet of 15-inch wrought-iron pipe; and this gives an excellent condensing capacity before the condensers are reached.

The chimney stack is just outside the house. It is of ordinary red brick, and is fire-brick lined—being furnished at the head with special fire-lumps from Scotland. The height is 87 feet; and the inside measurement is, at the bottom, 4 ft. 8 in. square, and at the top 4 ft. 6 in. Inside, therefore, it is practically parallel throughout.

There are one or two other notes about the retort-house that may be introduced here, before proceeding to notice the coal-store and its interesting equipment, which is quite a feature of the new works. The retorts are charged by means of scoops dealt with by Messrs. Biggs, Wall, and Co.'s simple and well-known type of "Rapid" manual machinery, which the men find a great relief from the old hand work, and a powerful assistance in expeditiously performing their duties. It may be that, when extensions in the house and beds are made, power machinery will be applied—of course, assuming that horizontals are, in the future, adhered to. When the works were visited last week, charges of $3\frac{3}{4}$ cwt. of East Pontop and Aldwarke main coal were being used. Mr. Couper has not had the opportunity yet of making more than estimates of his production; but he takes it at between 10,000 and 11,000 cubic feet of 16-candle power gas per ton.

The retorts are drawn into hand barrows, which are wheeled on to an extension of the stage-floor outside the house. Elevated inside the house is a water-tank, which feeds a large rose-headed sprinkler fixed over the exterior portion of the stage-floor. The coke-barrows containing the incandescent coke are wheeled outside. Just inside the entrance to the retort-house is situated, on the outlet-pipe from the overhead tank, a cock operated by lever-and-chains; and by these means the coke is quenched. There is one thing that Mr. Couper pays very strict attention to, and that is economy in the matter of his water supply. He gets as much as he can for nothing; and he lets as little as possible be wasted that can be put to further good use. The whole of the water passing through the coke flows off by a drain into a huge tub beneath. In this, the coke dust carried off by the quenching

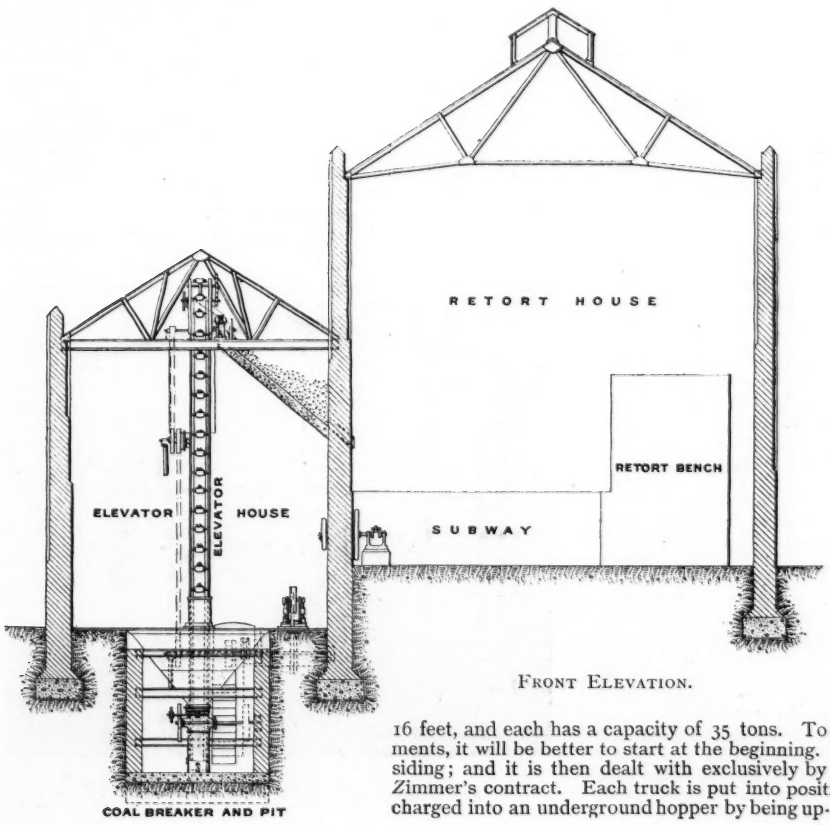


SIDE ELEVATION OF COAL-STORE, SHOWING COAL-HANDLING ARRANGEMENTS.

water is collected; the water itself escaping over the top of the tub to a drain below, and is collected in an underground tank—being re-pumped to the overhead tank in the retort-house as occasion may demand. From this outer stage, is a wooden gantry passing over to the coke storage yard; and along this the coke-barrows are wheeled. The staging is fitted with some of the old channel-irons from the dismantled holder previously referred to, to serve as guides for the barrow wheels, as well as to prevent accident from the running off of the barrows. It should be noted, in this connection, that arrangements have been made for the adoption eventually of a coke-conveyor underneath the stage-floor. The necessary doors have already been fixed in the floor; the openings being placed immediately over the position which the conveyor is intended to occupy.

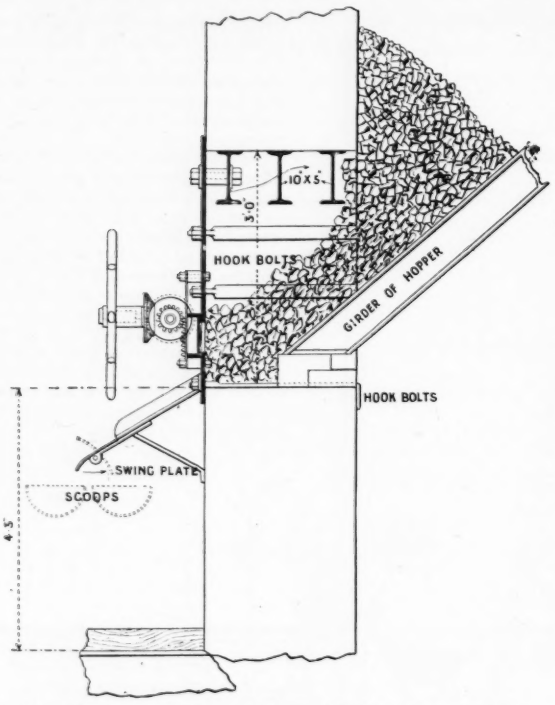
Now we come to the coal-store, which is reached from the outside stage previously referred to by an iron stairway. This store is at a lower level than the retort-house, owing to the peculiar formation of the site. The floor is 5 feet lower than the basement floor of the retort-house, and some 13 feet lower than the stage-floor of the latter. The height of the store is 27 feet; and the width 25 feet, being of the same length as the retort-house. In this instance, the roof has been specially constructed in view of the fact that the ironwork has to carry the weight of two large coal-hoppers, a water-tank, and an overhead swinging conveyor of the Zimmer type. The weight of these is chiefly borne by twelve 12-in. by 6-in. girders thrown from side to side; and the ironwork of the roof is built up of $3\frac{1}{2}$ in. by 3 in. by $\frac{3}{8}$ in. principals, and $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{3}{8}$ in. struts, both of T steel. There are special drawings given of the coal storing arrangements; and they are of more than ordinary interest, having features which are somewhat novel for gas-works.

A little hint has been made of the steps taken by Mr. Couper to obtain free supplies of soft water; and here this may be more particularly alluded to, in view of the fact that, in the roof of the coal-store, a tank has been constructed to collect the rain water from the retort-house and coal-store roofs. This tank is 4 ft. by 3 ft. by 72 ft. long, and has a storage capacity of 5400 gallons. It is a splendid tank, and is a great convenience and source of economy. In addition, out in the yard (close to the new gasholder), there is a well some 28 feet deep, which serves as a collecting well for rain water percolating through from the neighbouring hills. This water is pumped up by means of a pulsometer; and its sinking has been, and will continue to be, a very profitable investment. This soft water is chiefly used for the boilers; and it saves the Company a considerable sum of money.



FRONT ELEVATION.

The large tank is supported on the girders referred to. Above it galvanized iron tanks have been provided, which usually act as interceptors of dust; but they can also be utilized as tanks for the softening of hard water—the softened water gravitating to the larger tank beneath. To the girders also diagonally-fixed joists are joined to form sloping bottoms to two coal-hoppers next the wall partitioning the coal-store from the retort-house. The purpose of these inclined bottoms will be explained presently. The two hoppers are 18 feet long by 16 feet, and each has a capacity of 35 tons. To properly appreciate the storing arrangements, it will be better to start at the beginning. The coal is brought into the works by the siding; and it is then dealt with exclusively by the machinery erected under Mr. G. F. Zimmer's contract. Each truck is put into position by means of a turntable, and is discharged into an underground hopper by being up-ended by a hydraulic lift. The turntable



THE METHOD OF FILLING THE SCOOPS THROUGH THE COAL-STORE WALL.

allows the empty railway trucks to be turned into a bay running between the outside stage referred to previously and the coke ground which is at a higher level than the turntable. It is Mr. Couper's intention to extend the outside stage, and to have a jigger screen fixed up so as to sort and load coke direct from the barrows into the railway trucks—the breeze being collected, and taken away for boiler use.

That is, however, a matter for the future. The coal-trucks, as stated, are up-ended and discharged into an underground hopper, which has a capacity of 14 tons. It is of V shape, and of very substantial build. All the coal passes through a pair of breaking rollers at the base, and is then delivered into the boot of the bucket elevator, which, with good work, is capable of dealing with an 8-ton truck of coal in half-an-hour. The elevator places the coal on to the overhead Zimmer conveyor (some 48 feet long), and delivers, as required, into the hoppers previously described, or, if these are full, into (through shoots) the store below. There is a gangway running alongside the overhead conveyor; and to this access is obtained by a ladder running from the stage-floor in the retort-house. By these means the men control the arrangements by which delivery of the coal is made at any point required. When the hoppers need replenishing, and there do not happen to be any trucks in for unloading, coal has to be taken from store; and here we have another interesting feature of the coal arrangements. Beneath the store is a tunnel (5 ft. deep by 4 ft. 6 in. wide), formed of 5 in. by 3 in. T bars spaced 2 feet apart, and covered with sheet steel, with sliding openings. In this tunnel, there is a second Zimmer conveyor, 60 feet long, which carries the coal from store to the foot of the elevator, which once more raises it to the overhead conveyor—being this time delivered into the overhead hoppers. All this coal machinery is driven by a 14-horse power steam-engine. The engine is situated in one corner of the basement of the retort-house; being housed-in by a structure in large part glazed, so as to give the full benefit of the light, and to enable the men as they pass to observe how the engine is working, without necessarily going into the place.

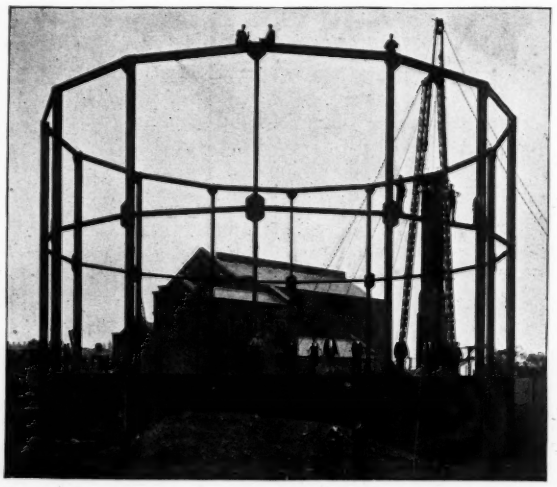
Two things have been mentioned, to which we have now again to refer. The first is the sloping bottoms of the hoppers, and the second is that the retorts are charged by scoops handled by Messrs. Biggs, Wall, and Co.'s machinery. There is a connection between the one and the other. The inclined bottom of each hopper is continued through an opening in the retort-house wall. This narrow opening is the full length of a scoop, and is fitted with a sliding door, working up and down by a hand-wheel operating a rack-and-pinion shaft. The sheet-iron slope is continued, and projects out into the house. Under this projection, the scoops are brought two at a time on a carriage. The sliding door is opened, coal flows out and fills the first scoop; and then there is another simple operation which fills the second scoop. The outer portion of the slope is, though continuous with it, separate from the main part. It is really a swing-plate fixed to a rod, which, by means of a lever at one end, is turned, causing the swing-plate to serve as a shoot to direct the coal into the second scoop. The filling of the two scoops is smartly and evenly performed—indeed, it is done in far less time than it would take the men to do the work by shovel and hand. In addition, there is no coal in the retort-house itself; and the whole stage is kept perfectly clean. Other than the scoop carriage, the scoops, and the men's ordinary tools, there is nothing on the stage to impede the retort work. The feeding arrangements from the coal-store were constructed by Messrs. Cockey and Sons, Limited.

From the stage outside the retort-house, ascent is made, by an iron stairway, to the upper apartments of the adjacent building. These have been allocated to the service of the men, comprising a large airy mess-room, a washing and bath room, and lockers. The first room is fitted with a stove and oven; and the washing and bath room with soft and hot and cold water—the bath-room being heated by a steam-coil. The rooms are well ventilated; and these and the other parts of the same building are fitted with windows which can be opened when desired all down, louvre fashion. The men find the rooms comfortable and convenient; and there is no question about them making good use of them, even to the bath-room.

The rooms in the lower part of the building are of a size suitable for future additions of plant. At the present time, in the exhauster-room, there are two exhausters of Messrs. Bryan Donkin and Clench's make—one being of an hourly capacity of 20,000 cubic feet and the other of 30,000 cubic feet. The room is fitted with jet photometers to indicate the quality of the gas being made and of the outgoing gas, as well as with the necessary gauges. At night-time, the room is lighted by an incandescent burner in a lantern built into the wall, and glazed on all sides—giving light both inside and outside the room. The boiler-house contains two boilers—one for winter, and the other for summer use, both being fitted with Wilton's furnaces. The large one is 22 feet by 5 ft. 6 in.; and the smaller one is only 15 feet by 4 feet. The latter came from the old section of the works; but a bricked-in archway has been left in the side of the house, so that the small boiler can be replaced by a larger one when required without much difficulty. Underneath the exhauster-room is the pump-room. One of Evans's tar and liquor pumps has already been installed; and a water-pump is also arranged for, as well as an engine for driving the jigger sieve for dealing with the coke in the manner already explained. The walls and floors of these machinery-rooms will be finished in a style which will give them a clean and trim appearance. Just outside the boiler-house is an underground tar-tank, in which only the tar is stored; the liquor being carried away, by a pipe-line, to the large tank on the old site.

Close by, there is a range of sheds (left by the former owners of the land) which have been temporarily converted into workshops and stores. Here stove repairing is found going on; and the shop is fitted with an apparatus for enamelling parts of the stoves. There is a store for tubes and all the numerous odds and ends required for both indoor and outdoor work, and a good smithy adjoins.

Attention must now be directed to the new two-lift gasholder, which has been erected by Messrs. Cockey and Sons, Limited. It is built in a steel tank, and has a capacity of 225,000 cubic feet. It has been designed, so that a third lift may be added; the upper one then running free of the framing, after the manner of the newer of the South Metropolitan Gas Company's holders. When the third lift is added, the holder will have a storage capacity of 345,000 cubic feet. As it stands to-day, it has brought the Company's total storage up to 365,000 cubic feet. Without going deeply into detail, a few structural particulars may being interest. The inner lift is 81 feet diameter by 22 feet deep; and the middle lift, 83 feet diameter by 22 feet deep. The latter is provided with a cup at the bottom in readiness for the outer lift, which will be 85 feet diameter by 22 feet deep. The dome on the crown of the inner lift has a rise 4 feet above the curb. The hydraulic cups of the inner lift are of the bent or circular form, and are 8 inches wide by 16 inches deep. The tank is composed



THE NEW GASHOLDER UNDER CONSTRUCTION.

of steel plates and bars throughout, and is 87 feet in diameter and 23 feet deep, with flat bottom. There are 28 rest blocks, 12 inches deep, fixed in the bottom of the tank at equal distance around the circumference; and a pillar is provided in the centre of the tank for receiving the centre pillar of the holder when at rest. A platform (with handrail) has been constructed around the upper part of the tank. The holder guide-framing consists of fourteen standards running the full working height of the holder, and extending to the bottom of the tank. These are formed of steel joists, 14 in. by 6 in. by 46 lbs. per foot; each standard being constructed in three lengths. The lower row of girders are of steel joist, 8 in. by 6 in. by 34 lbs. per foot; the upper girders, 14 in. by 6 in. by 46 lbs. per foot. The diagonals are of steel joists, 6 in. by 5 in. by 25 lbs. per foot. The inlet and outlet pipes are of 18 inches diameter.

A short distance away is a new station meter house, 30 ft. by 21 ft., lofty, and erected in a style to correspond with the other buildings. When the interior is finished, with a pitch-pine dado, and a good floor, it will look very well indeed. A Parkinson and Cowan station meter of 30,000 cubic feet per hour has been erected here; and in the house there is also a new governor (by the same firm) for the Brentwood portion of the district, and one (by the Gas-Meter Company) brought over from the old works for the Warley district. In the section of the 18-inch main running in front of the meter, Mr. Couper has put in a cheap, but sufficiently efficient for his purposes, form of carburettor. It merely consists of a steam-coil and tray, by means of which the gas is enriched by benzol.

Nothing more by way of description can be usefully said about the new works; but passing over to the old section, it is seen that the purifying plant has received an addition in shape of a Holmes washer, of 500,000 cubic feet capacity. The old retort-houses and coal store are going to be done up as needed, and be devoted to other service. Already part of the large one is being occupied by the erection of one of Messrs. R. & J. Dempster's sulphate of ammonia plants, capable of a production of 1¼ tons per day. The saturator is one by Messrs. Joseph Taylor and Co.

A good entrance and straight road into the works has been constructed; and on the public road side of the yard, a nice oak fence has been built with a brick base.

A few words by way of concluding this description of a works which will appeal to many readers who have charge of works of corresponding size, and with prospects of a like character. Skill and circumspection characterize the plans. On every hand provision is made for extension; and, indeed, the future is markedly arranged for, on economical lines. Only one decisive affirmative answer could be given to the question as to whether the Directors acted wisely in endorsing this large scheme for modern works. Every conceivable interest demanded it. When the new picture is looked upon, and then the old, happy must all be who are concerned in the existence now of the former. The new works are capable of producing 380,000 cubic feet of gas per day; and anxiety for the present as to the supply being equal to the demand has been lifted entirely. The judgment of competent men will be that the Engineer has done excellently; and that the various contractors have performed their part honestly and well—justifying once more the confidence reposed in them.

A Fancied Defect in Slot Meters.—A writer in "Electricity" says a defect in the practical application of slot meters was brought under his notice some time ago, in connection with gas supply. "With a view to simplicity of construction, and avoidance of disputes between the supply authorities and the consumer, these meters *usually allow a less quantity of gas to pass than the consumer is entitled to by virtue of the coins inserted;* so that the collector, after deducting the sum shown to be due by the difference between the meter readings, should return this surplus to the consumer. In the cases referred to, receipts for the sums taken were given on paper slips, which were not duplicated, neither were the meter readings stated on which the charges were based, and, on reading the meters, it was found that more cash should have been returned. Apparently this had been going on for some time, as, since pointing it out to the supply authorities, the sums so returned have increased to two or three times their value in proportion to the quantity consumed, although the meters, and average consumption, have remained unchanged. Now, as scarcely one consumer in a hundred understands how to read his meter, it is evident that this state of affairs will, in the long run, prove detrimental to the supply company, as any mistake, or defalcation, to the consumer's disadvantage is not rectified, and the popularity of the supply will suffer in consequence." We fancy the writer of the foregoing has become muddled by a case in which there has been a reduction in the price of gas, and instead of altering the whole of the slot meters, the gas suppliers have been making a money allowance when the collections took place. The term "usually" has evidently been applied without sufficient investigation into the "usual" practice. However, the remedy suggested by the writer is: "Firstly, that all such meters should be fitted with a dial registering the number of coins inserted, and capable of being set to zero every time the till is emptied. Secondly, that receipts be given on duplicate forms, showing the meter readings at the present and previous dates, difference between them, rate charged, amount taken in payment, and amount returned to the consumer." Originality is not the characteristic of these suggestions.

THE GAS AND WATER STOCK MARKET.

THE Stock Exchange has just had one of the brightest weeks it has had for many a long day. Re-opening on Tuesday after the Easter holiday, it became at once apparent that the cheerful feeling with which it had closed had not died in the interval. This rapidly intensified; and people in general seemed to have made up their minds that a real turn in the tide had come at last. Prices rose freely; and not even the inevitable profit-snatching which supervened could altogether stem the rise. The buoyant tendency lasted right up to the close, when Consols marked 87⅛—more than one point above the lowest price of Tuesday. The Money Market looked like ease at first; but it soon stiffened up, and then relaxed again and closed easy. Discount rates ran much about the same course. Business in the Gas Market was fairly active, considering that it usually takes some little time for it to get into swing after holidays. Prices generally were firm, coupled with a moderate improvement in some half-a-dozen issues. It is to be hoped that the general improvement in the Stock Exchange as a whole may soon extend to this market. With the exception of a few issues (mostly Suburban or Provincial) which seem to enjoy special favour, it may be said that the prices of even first-class Gas securities have for a long while stood very low. As the gas industry has done very well during this period, the cause of the depression must be extrinsic, and is no doubt attributable to the same factors as those which have been crushing all markets, from Consols downward. If it be really true, as many good judges believe, that this incubus is now being permanently lifted, then Gas securities should rise with the rest. In Gaslight and Coke issues last week, good steady business was done in the ordinary at prices rather better than those of the previous week—87⅞-88¾ being the limit of variation. The secured issues were quiet and unchanged. South Metropolitan was moderately dealt in at figures ranging from 117⅞ to 118¾. Commercials were inactive. Very few transactions were marked in the Suburban and Provincial group. Crystal Palace had a rise of a couple of points. In their local Exchanges, Liverpool "A" was rather higher, and Newcastle rather lower. In the Continental Companies, Union was put down 3; but buyers came in and put it back again. The preference was also raised 2. Imperial was still on the rise, and changed hands at 203. In the remoter undertakings, San Paulo recovered fractionally, and Melbournes came out rather better on *ex div.* adjustment. Business in the Water Companies was very tame; some days being quite blank. Nothing moved but New River, which had a fall.

The movements were: On Tuesday, Imperial improved 1; Continental Union fell 3. Wednesday and Thursday were unchanged. On Friday, Crystal Palace and Imperial advanced 2 each; Continental Union recovered 1; and San Paulo ½. In Water, New River fell 5. On Saturday, Continental Union ordinary and preference impoved 2 each.

THE VALUE OF A GAS UNDERTAKING.

By Mr. NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

The letter by Mr. E. A. Harman, of Huddersfield, published on p. 346 of the "JOURNAL" for Feb. 9, directs attention to the interesting fact that the actual value of a gas-works as a business concern is affected by various incidental matters beyond human control. The united efforts of the engineers and contractors may be a plant that defies competition in the matter of capital outlay per million cubic feet of productive capacity; but its actual value as a dividend-earning concern may be prejudiced to an indefinite extent by the character of the consumption as affecting the ratio between the maximum daily output and the annual consumption. This ratio may or may not be susceptible of improvement. The introduction of cookers and engines is a move in this direction; but gas-fires and heating stoves tell against it. Few can afford to pick and choose as regards the character of new and additional business. The usual practice is to take all that comes along; and the engineer who refused gas-fires on the ground that they interfered with the desired reduction of ratio, would be looked upon as something of a crank.

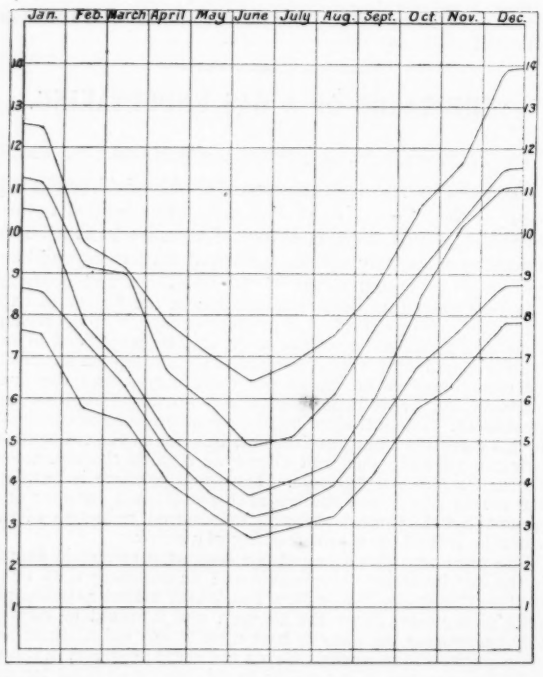
The maximum day's output is a somewhat uncertain quantity. In the district about to be considered, an unusually dark or cold spell on Christmas Eve or New Year's Day means a consumption quite 10 per cent. above the normal; and it would be considerably overstating the case to base upon it any calculations as to the capacity of the works. Given the usual provision in the way of holder capacity, it is possible to tide over a week or ten days' extra consumption caused by fog or cold, even if the capacity is not greater than the equivalent of the average day's output on the month. Something turns upon the nature and character of the district supplied. In ordinary provincial towns in the South of England, it would be quite safe to take the average of the month of December; but in large towns, or in colder climates, a shorter period—say, a week or a fortnight—might be preferable. Even if a week is taken, the quantity will be appreciably below that of a single day.

The accompanying table shows the development of a rather slow-going provincial district, as evidenced by the monthly consumption at quinquennial periods from 1883 to 1903. During that time there has been a moderate natural increase in the extension of the district, but no substantial addition of a character sufficient to largely affect the results. The large increase in the last three months of 1903 is due to unusual activity in the matter of slot-meter business during the summer, and to extended street lighting. The total output has nearly doubled—having risen from 60 millions in 1883 to 111 millions in 1903. The chief factor

—	1883.	1888.	1893.	1898.	1903.
Jan.	7,538,000	8,509,200	10,411,500	11,133,300	12,449,400
Feb.	5,783,100	7,405,200	7,792,100	9,128,000	9,706,900
March	5,545,700	6,308,900	6,761,500	8,972,400	9,122,700
April	4,007,600	4,747,100	5,150,800	6,623,800	7,809,500
May	3,299,000	3,761,600	4,340,300	5,813,000	7,035,300
June	2,645,000	3,168,200	3,681,300	4,840,600	6,399,500
July	2,900,300	3,420,000	4,030,800	5,069,300	6,812,400
Aug.	3,145,800	3,905,100	4,490,500	6,077,600	7,481,600
Sept.	4,211,500	4,920,400	6,078,900	7,760,800	8,708,700
Oct.	5,749,800	6,720,900	8,318,500	8,991,000	10,530,200
Nov.	6,918,100	7,654,200	10,042,000	10,217,500	11,605,700
Dec.	7,726,500	8,627,800	11,024,100	11,445,600	13,791,500
Total	59,478,100	69,148,600	82,122,300	96,073,900	111,453,400

concerned in this increase is the placing of cookers, water-boilers, and gas-fires, and within the last year to the increased lighting following the establishment of a good maintenance system. The only active effort made in the way of extending business was the establishment of a show-room, the holding of a few cookery demonstrations, and the supply of cookers on hire at a moderate rental and fixing them free up to a limit of 30 feet of piping. Nothing further has been done, for the simple reason that orders came in as fast as the staff available could deal with them. If canvassing or anything like push had been resorted to, a much larger increase would have been shown.

In 1883, the maximum day's consumption, as arrived at by taking the average for the month, was 249,000 cubic feet; and the ratio as compared with the year's output was 1 : 238. In 1898, (1903 is omitted for the reason above stated) the maximum daily output on a similar basis was 370,000; and the ratio, 1 : 260. But looking at the large increase in summer business, one would expect considerably better results. The minimum day's consumption—as shown by striking the average for the month of June—was 88,000 cubic feet in 1883, and 213,000 cubic feet in 1903; and the respective ratios, 1 : 676, and 1 : 523. In 1883, the ratio between the minimum and the maximum consumption was nearly as 1 : 3; ut in 1903 t was more like 1 : 2.



The importance of the increase in summer business may be illustrated in another way, by taking the four summer months. In 1883, the consumption was about 12 millions; but in 1903, it was nearly 29 millions. The summer consumption has increased 240 per cent.; but the benefit, as regards a reduction of the ratio, has been partly neutralized by the gas-fires in the winter. In 1883, the total number of gas cookers in the district was well under 100; while in 1903, it was over 1000. During the twenty years, a considerable number of washing-coppers or water-boilers (ranging from 10-gallon up to 50-gallon capacity) have been introduced. The same period has seen a large extension in the use of gas warming apparatus.

Two matters that have attracted a good deal of public attention as influencing gas consumption—the gradual adoption of incandescent burners, whereby a consumption of 2 to 3 feet per hour replaces one of 5 to 6 feet, and the competition of electricity—do not afford any evidence of existence in the table. Yet within the last quinquennial period, electricity has been actively canvassed in the district, and very liberal arrangements in the matter of fittings have been offered as an inducement, or rather as removing the objection of first cost. Yet the table shows no loss due to the reduced consumption of incandescent burners, or to the replacement of gas-burners by electric lamps.

The diagram exhibits in graphic form the figures quoted in the table. It is constructed by marking the months of the year by means of vertical lines, and million feet of gas by means of horizontal lines, placing a dot in the correct position to indicate the consumption for each month, and joining up the dots by means of lines. The series of curves obtained show the yearly consumption; and it is remarkable that they do not overlap, but show a steady advance all along the line. With the exception of the upward tendency, they have a strong family likeness.

NEW LAMPS FOR OLD.

By R. J. Milbourne, Assoc.M.Inst.C.E.

From a mere experimental science, electricity has grown during the past twenty years to a commercial success, giving rise to the profession of electrical engineering. The greatest development has certainly been in the direction of lighting. When we consider that a little more than twenty years ago electric lighting was an "unknown quantity," commercially speaking, and that now every medium-sized town is lit up with it, it would be thought that its marvellous progress was its own recommendation. No doubt great credit is due to the inventiveness and energy of those who have been instrumental in forwarding—in fact, building up—this wonderful and splendid industry. They have fought against enormous odds. Difficulties innumerable were continually facing them, and could only be overcome by the exercise of skill and science of a high order. It would be difficult to say how many minor or subordinate industries have blossomed forth and been called in to aid the progress of the main industry. The perfection and finish to which the thousand-and-one fittings, instruments, and various accessories used in electrical engineering have been brought are deserving of the highest praise, and cannot but claim our admiration.

It was in or about the year 1880 that the first experiment in electric lighting on a commercial scale was made in England. At Westgate-on-Sea a small installation of arc lamps was fitted up on the sea front. There were six lamps 80 yards apart. They were on the Jablochkoff candle principle which was probably the most advanced system available at that period, but now commercially extinct. It is curious that this experiment was conducted by a few gas men in the interests of science, one of them being the late Mr. W. H. Bennett, who was at that time the Secretary of the British Association of Gas Managers. He published a pamphlet giving the result of the experiments, in which various deductions were made as to the advantages of electricity compared with gas. Some of the drawbacks urged in it against the "new light" would read rather curiously now, in view of the important position the new light at present occupies. One of the principal drawbacks at that time was the cost, which appeared to work out at eight times that of gas. The Jablochkoff system was also installed on the Thames Embankment; and no doubt many are still able to remember the weird and kaleidoscopic vagaries of these lights, which shed their radiance around in all the colours of the rainbow. At that time incandescent electric lighting was unknown outside the laboratory, though several theories as to its practicability had been published by scientific men. Its application on a large scale was worked out by Edison.

Since then great progress has been made in both electric and gas lighting. The incandescent gas-burner, if in existence at all, was of not much commercial importance: the improvements in gas lighting consisting for some time of increased light, accompanied by higher consumption and greater objections. Modifications of the argand burner were introduced; and various designs of regenerative burners, known as "Sunlight" and by countless other names, came into the market. They nearly all required some little skill to manipulate them; and if left to themselves, they developed bad habits, such as smoking furiously, giving off offensive odours, and finally choking themselves out. It is to be hoped that they have choked themselves off the face of the earth. There was one gas light which had an enormous vogue in the eighties, and that was the albo-carbon light. Hundreds of shops and houses had these burners in use, so there was probably some merit in the system.

The gas companies then, as now, did not devote so much attention to the efforts of outside inventors, nor did they hold out so much inducement to promoters of new systems of lighting which had chiefly for their object the production of more light at a reduced cost for gas, as one would have thought they might have done; but when the enormous number of new inventions, both in

gas production methods and lighting methods, which are continually being brought out, is considered, there is no doubt they had their hands pretty full. Moreover, they had not begun to feel the urgency of competition. Their ways were also very "set." They were mostly in a condition of plethoric plenipotence—a kind of turtle soup and golden spoon condition—with a prosperity curve continually rising. Their position was apparently unassailable. They had their "districts," and over these they were monarchs of all they surveyed. Gas was a necessity, and those who wanted it had to make application for it, while those who did not want it were of another faith. But presently the prosperity curve began to flatten, assume the horizontal, and then to descend. This was when the effect of the "new" light began to be felt, and large areas which had been previously lit by gas were given over to the electric light companies. It was quite clear to the public that gas was doomed; and one public man described it as a "moribund industry." However, the incandescent burner and mantle now began to find their real opportunity; and, in spite of the methods of the promoters, the system grew rapidly into favour. The incandescent light, coupled with the increasing use of gas cooking-stoves, also the fortunate advent of the automatic meter—or, more correctly speaking, the prepayment meter—caused the prosperity curve to soar aloft once more. The gas companies cannot be too grateful for the invention of this meter; nor can the public be too grateful to the electric light for forcing its adoption upon the gas companies.

It is worth while to pause and remark on the extraordinary change of policy which this invention has effected. Before it came, the gas companies undertook no responsibility beyond the meter. This, of course, is still maintained with their ordinary consumers. The companies no doubt know their own business best; but the consumer is, in a measure, between two stools. When anything goes wrong with the gas, he invariably sends to the company. In nine cases out of ten, the fault is in the fittings beyond the meter, for which the company are not responsible; though occasionally the fault is with the company's system. But in every case they have to send a representative to make an examination, and the man's time is wasted; whereas if they adopted a system of maintenance or responsibility for fittings throughout, the man would not require to spend very much more time in adjusting the slight fault in the pipes or fittings beyond the meter than he already does in examining the company's part of the system.

This attitude of the gas companies with regard to their quarterly customers is a somewhat curious contrast to the one they adopt with their "automatic" customers. For the former they do as little, and for the latter as much, as possible; and there is no doubt whatever that, had it not been for the electric light companies commencing to fit up houses free, and charge for the fittings by a slight increase in the cost of the current, the gas companies would never have decided to utilize a means of bringing gas into the houses of the poorer classes on the prepayment system. In the "JOURNAL" for the 23rd of February last there is a letter signed "La Luz," complaining of the methods of the gas company ruling the district in which his house is situated. It must be admitted that the methods described are identical with those of many other companies. There is the usual document dealing with "Terms and Conditions for the Supply of Gas," which is utterly useless, and should be abolished. The honest consumer does not require it, and is insulted by it. The dishonest consumer utterly ignores it—in fact, glories all the more in "doing" the company, since he looks upon the paper as a challenge. "La Luz" winds up by saying "the sooner the electric light arrives in the neighbourhood referred to (and it is not far away), the better for the company and the consumers."

Gas companies are naturally only the same as other business concerns—they will not alter their system until they are compelled to do so by competition. They are now fully alive to all the marvels accomplished by electrical engineers in the direction of lighting, and are properly on their mettle. It behoves them to speak out plainly, and let the public see that the electric light is still many times dearer than gas. It is a pity the public need any instruction at all on this point; but that they do is due, in a measure, to the silence of gas companies on the one hand, and on the other to the volubility of the electric light people, who never lose the opportunity of giving the public actual figures for their guidance in deciding whether or not they should adopt electric or gas lighting. Strange to say, these figures always leave incandescent gas lighting and other improved systems entirely out of the question. They compare electric lighting with gas—not with gas "lighting." They say an electric glow lamp has so many candle power for so many watts per candle, and costs so much, while gas gives the light of so many candles per cubic foot burnt at the rate of so many cubic feet per hour, and costs so much—the "so much" of gas always being a little higher than the "so much" of the electric light; and the victim is thereby convinced, and only begins to wonder what it means when his quarterly bill comes in. One is led to ask whether the electric light people are really so ignorant as they make out with regard to the incandescent gas-light, or are only "artful"—whether it is that, when they pass through a well-lighted street and see incandescent gas-burners in every shop window, they delude themselves with the idea it is the electric light they are looking at. It is quite possible, for even a gas man might be deceived, except that gas is too bright and steady to be mistaken for electricity. There is no doubt, however, that the electric light people would be very wroth if the gas people based their calculations on the cost of electric light twenty years ago, when it was proved that electric lighting by arc lamps was eight times the cost of gas with flat-flame burners. If they did, they could prove that modern gas lighting was one-fiftieth the cost of electric lighting. But gas managers are not so bad as that; for they are above trying to "bluff" the public with fictitious figures as to costs.

In all business statements, it is well to be on the safe side, and not to promise more than can be performed, because sooner or later the inevitable climbing-down operation has to be undergone, which is humiliating and repugnant. Without necessarily handicapping themselves, gas managers can concede to their opponents all the advantages they claim, and discount their own claims, so as not to be accused of exaggeration, by (say) 16 per cent.; and it can then be demonstrated, without the slightest fear of contradiction, that, light for light, electric lighting is more than six times the cost of gas lighting. The electric people are steadily assuring a credulous and eager public that gas is the Rip Van Winkle, only that he is still asleep, even though the legendary twenty years have long since elapsed; and, therefore, in their circulars and catalogues, they, with apparent sincerity (looking at it from the public's standpoint) display tables of figures showing the relative costs of gas and electric lighting which are, of course, so simple that a mere child could understand them. The figures themselves are absolutely correct—that is to say, the arithmetical part is. The only thing wrong about them is the use of an obsolete constant. The use of this makes all the difference in favour of the electric light (what this difference is will be seen by the figures given a little farther on); but the layman cannot be expected to be capable of possessing the necessary experience or knowledge to enable him to substitute the true constant for the false or obsolete one. Therefore he is invariably doomed to severe disappointment. He is to be pitied instead of blamed, because, in deciding which is the best light to adopt, he has until recently had little or no guidance whatever from the people who make the gas side of the question. The only figures within his reach have been supplied to him by the electricians; and naturally these are in favour of their light.

Now, gas engineers and managers at large, having the gas industry at heart, should never lose an opportunity of putting the true state of affairs before the public. They should study the doings and sayings of the electrical engineers. Every gas manager should endeavour to be as up-to-date in electrical work as he is in gas matters. By subscribing regularly for an electrical paper, he would be in touch with all the latest improvements in the electrical world, and furthermore would be able to combat the electricians' erroneous statements—erroneous only, as a rule, where they concern the relative cost of gas and electricity. It is his right and his duty to do this; and he need have no fear whatever but that he can win.

The following is an instance of the complacent, and, to gas managers, somewhat whimsical, way the advocates of electricity have of putting their case before the public. In a very able article on electric lighting which appeared recently in a contemporary, the statement was made that "the people who say least about the cost of electric lighting are the users; while those who say most are the gas companies, and those who know most are the electrical engineers. But there is a perfectly definite and honest method of calculation which will show the comparative cost of gas and electric lighting under given circumstances." Then follows the "perfectly definite and honest method of calculation" referred to.

Gas Lighting.—2½ c.p. required 1 cubic foot for one hour, which costs 2s. 10d. ÷ 1000 or 34d. ÷ 1000 = pence.

Electric Lighting.—2½ c.p. requires 3·4 watts × 2·5 c.p. × 1 hour = 8·5 watt-hours, which at xd. per unit will equal $8{\cdot}5 \times x \div 1000$ = pence.

Equating these two statements, we have—

$$\frac{34}{1000} = \frac{8{\cdot}5 \times x}{1000} \text{ or } x = 4.$$

Therefore, on the above assumption of 3·4 watts per candle power and 2½ candle power per cubic foot of gas, gas at 2s. 10d. per 1000 cubic feet would be equivalent, *light for light generated*, to electricity which costs 4d. per B.T.U.

It will be seen that the author of the above statements bases his "perfectly definite and honest method of calculation" on gas of 12½-candle power at 2s. 10d. per 1000 cubic feet, and electricity at 4d. per unit. While electricity at this figure is at a fairly low average price, gas of 12½-candle power at 2s. 10d. is certainly dear. But even if, for the sake of argument, we accept this figure as correct with regard to gas, it will at once be seen that the extra light obtained by the use of the incandescent gas-burner is entirely ignored. The Welsbach people claim that one of their burners gives a light of 50 candles with a consumption of 2½ cubic feet of gas per hour. There are other makers of incandescent burners who claim 70-candle power with a consumption of 2¼ cubic feet per hour. But, as has been said, it is best not to promise too much; and therefore, if we assume that an incandescent gas-burner gives a light of 40 candles with a consumption of 2½ cubic feet per hour, we shall be on the safe side. Then we get the following figures:—

Gas Lighting.—40 ÷ 2½ = 16 candles per cubic foot, at 2s. 10d. per 1000 cubic feet.

Electric Lighting.—16 c.p. requires 3·4 watts × 16 c.p. × 1 hour = 54·4 watts, which at *x*d. per unit will cost 54·4 × *x* ÷ 1000 = 0·625d.

Therefore electricity would have to be sold at 5-8ths of a penny per unit in order to be as cheap as 12½ candle gas at 2s. 10d. per 1000 cubic feet. Light for light, then, electric lighting, on the above figures, is 6·4 times the cost of gas. So much for the "perfectly definite and honest method of calculation" practiced by electricians.

Now, the curious thing about most electrical engineers is this. When they are taken up on their own figures and challenged thereon, and told plainly that they have made deliberate attempts to mislead the public by using an out-of-date constant in their calculations, they drop figures like a hot coal—and wisely, because they find they burn their fingers. They say: "Don't take any notice of figures. They are beautiful; anything can be proved by figures." Then they cite actual instances of cases where gas has been thrown out of use in favour of electricity, and an enormous saving effected. Without mincing words, all such statements are absolutely unsupportable. The actual instances stated by the electricians, when they come to be examined, generally amount to something like the following: "I know a man who used gas for years, and was so disgusted with it that he gave it up, and went in for the electric light instead. He had seven rooms lit up with electric lights burning till twelve or one in the morning, and his bill for a whole year was only £2 9s. 4d., and the rate charged was 5d. per unit. Can you get gas cheaper than that?" The answer to such a statement is: "If your statement is true that your friend can light his house with electricity for one year at £2 9s. 4d., we can give him the same amount of light with gas for 7s. 9d. per year." Of course, arguing thus, brings the matter to a *reductio ad absurdum*.

A further proof urged by electricians in favour of their light is the continued displacement of gas by electricity. The gradual reversion to gas lighting by people who have tried both systems is not mentioned by them. They say: "If people will only notice the rate at which the general public, in all parts of the kingdom, exchange electric light in place of gas whenever an electric lighting scheme is started, they will be conscious of the fact that users either wilfully shut their eyes to the vaunted cheapness of incandescent gas lighting, or else do not find from experience the figures to be verified, which are constantly rammed down their throats by people whose business it is to supply gas." The mistake is that the people whose business it is to supply gas do not ram the figures sufficiently down the throats of the public. There are, no doubt, hundreds of cases where the electric light is adopted simply because *it is the electric light;* but nothing need be feared from these people. If money is no object, they may keep to the light; but if economy is essential, they will soon find out that they have made a mistake, provided the purveyors of gas keep up to the mark, and continually avail themselves of the many inventions brought out for their benefit, and bring them to the notice of the public.

It is gratifying to observe that the Gaslight and Coke Company are moving in this matter by causing their meter readers to leave circulars with their consumers which give them an opportunity of thinking out the relative costs of gas and electricity. This circular puts the matter in a nutshell, and is indisputable. The figures coincide almost exactly with those given in this article, and plainly prove that the same amount of light that can be obtained for 6d. with gas would cost 40d. with electricity. Other gas companies will, no doubt, follow suit, adapting their price accordingly. It will be seen from the circular referred to (a copy of which was published in the "JOURNAL" for Dec. 15), that the Company have adopted the system of mantle renewals, which is approaching practically the maintenance system urged by the author.

German Association of Gas and Water Engineers.—It is formally announced that the forthcoming 44th annual meeting of the Association will be held at Hanover from the 22nd to the 24th of June. There will be the customary assembly and reception on the evening of the 21st. The programme of proceedings will be issued later. The meeting will be under the presidency of Herr L. Körting, the Manager of the gas-works. Visitors, introduced by members of the Association, will be welcomed to the meeting.

Thawing Frozen Water-Pipes by Electricity.—The following method of thawing frozen water-pipes was recently employed by the Storage Battery Supply Company, of New York City, in a case in Brooklyn: It was assumed that the service-pipe, which was ½ inch diameter, was all that was frozen, so the workmen connected the feeders to the main in the street and the outlet in the cellar of the consumer's house. The pipe was about 80 feet long; and, with about 15 volts and 300 amperes, they raised its temperature to about 150° Fahr. where it was exposed in the cellar. They continued this for about 20 minutes, but no water came; so it was concluded that the main was frozen. As the adjacent house had a supply of water, they dug another hole and connected the feeders at this point, and also at the first location on the mains in the street. The main was a 2-inch galvanized pipe, and the distance about 20 feet. They used a pressure of 6 volts and about 1000 amperes; and only three minutes elapsed from the time of putting on the current to the appearance of water in the house.

JUNIORS AT SOUTHALL.

The Directors of the Brentford Gas Company and their Engineer (Mr. James Husband) have, with evidences of the utmost goodwill, frequently permitted their works to be visited by those interested; and on more than one occasion now have encouragement and generosity been extended by them to organizations of junior engineers. Under proper guidance, an inspection of the Company's works, and especially of the Southall ones, is a liberal education for the young engineer. They are, as we have before styled them, "The Home of the Inclined Retort in England;" and there the system in all its original simplicity can be seen and studied. There is nothing of a special character about the Company's several large installations of inclines. Buildings, settings, and everything else are of the plainest design; and yet their working goes on smoothly and regularly, and satisfactorily to the Engineer. In addition to the ordinary plant, there are the coke conveyors and water-gas apparatus, to engage the attention of the engineering visitor—all bearing the like outstanding feature of simplicity.

The London and Southern District Junior Gas Association were privileged to spend last Saturday afternoon on these works; and they received the same undivided and kindly attention of members of the Company's staff that previous visiting parties have enjoyed. It was regretted that other engagements prevented the presence of Mr. Husband, but Mr. W. Bugby, the Manager of the works, placed himself unreservedly at the disposal of the members, and he was assisted by Mr. R. H. Chree, of the Brentford works, and Mr. G. P. Heisch, the Manager of the Southall sulphate works. The number of the visitors must have been between 30 and 40; but unfortunately, the President (Mr. Walter Grafton) was unable to be from home. His place, however, was admirably filled by the Hon. Secretary and Treasurer (Mr. P. F. Scarth).

It goes without saying that the inclined retort-houses, and the methods of working, held the chief place in the interest of the young engineers; and they swarmed round the men while the discharging and charging of a number of retorts was in progress in one of the houses. No amount of written description could have taught them so much as was conveyed to their minds through their eyes, by the inspection and an ordinary working demonstration. The history up to date of the inclined work at Brentford and Southall was written and illustrated in the "JOURNAL" for Sept. 29 last; and to state again what the visitors saw on Saturday would only be to repeat what was then published. The new steel-framed retort-house, with its galvanized iron covering extending only about two-thirds down the sides (leaving the remainder quite open), and its simple settings (25 beds of sixes), constructed entirely without special bricks of any kind—all reflecting the mature views of the Engineer through his long years of experience with inclines—were inspected, and then one of the old houses (No. 4), in which the retorts were re-set last summer, was explored. The coke-conveying plant next came in for attention. Plate conveyors are used here; and the saving by them well repays the Company their expenditure. The new house has not yet been fitted with a conveyor; that is a matter for the future. But in the three older houses, the conveyors are in the basements. The coke is directed through shoots running the full length of the discharging-floors. It falls into large barrows, is quenched, and then tipped by the men into the conveyors, which carry their burdens to three outside elevators delivering on to overhead conveyors for depositing the coke in stock or loading up railway waggons. The best speed for the conveyors, from the point of view of wear and tear, is found to be 40 feet per minute. Above this the expense for wear and tear increases out of all ratio to the additional speed. But, of course, the work to be done dictates the speed.

The other parts of the coal-gas plant were then inspected. In looking round the purifying boxes, the visitors had their attention directed to one on the dry-lute principle which has been in use about 20 years; and therefore must have been one of the first dry-lutes in the Kingdom. It is about 50 ft. by 25 ft. in size, and a gaskin of white yarn and tallow is used.

A break in the inspection was made for tea, which had been kindly provided. The carburetted water-gas plant, which was erected by Messrs. Samuel Cutler and Sons, and was described when the Junior Institution of Engineers visited the works,* was subsequently inspected; and the sulphate of ammonia works followed. Here the members found that the old sulphate plant has been discarded, and work is now going on with a new plant, which was started about last November. It was supplied by the Chemical Engineering Company, being of the well-known Wilton type. It is capable of turning out 10 tons of sulphate a day. Only the Southall liquor is dealt with here; and the present annual make is from 900 to 1000 tons. The waste gases are worked up with a Claus kiln; the make of sulphur being roughly about 25 tons a year.

The governor-house was the last building to receive attention, and here Mr. Dougan took the opportunity of moving a vote of thanks to the Directors of the Company and Mr. Husband for allowing the members to inspect the works and for the hospitable way in which they had been entertained; also to Mr. Bugby and his assistants for the pains they had taken in explaining the many

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*See "JOURNAL," Vol. LXXVII., p. 676.

points of interest. He (Mr. Dougan) thought they would all go away greatly benefited by the instructive afternoon. The vote, he added, would be incomplete without mentioning the works band, which indicated the good feeling existing between the employers and employees. The music had been much enjoyed. Mr. Richmond seconded the motion with great pleasure. Mr. Bugby replied, saying that it had been a pleasure to show the members of the Association over the works; and he should be pleased to convey the vote of thanks to the Directors and to Mr. Husband.

One word further must be said in praise of the works band, which treated the visitors at intervals to excellent music. In this band there are about thirty members; and during the afternoon Mr. Gray was the conductor. The bandmaster and Mr. Gray must be congratulated upon the high degree of proficiency to which they have brought the band, the members of which have shown remarkable aptitude and ability.

The visitors left the works early in the evening, well pleased with the afternoon's treat and the kindly attentions that had been bestowed upon them.

BESEMFELDER'S MIXED-GAS PROCESS.

The process devised by Dr. E. R. Besemfelder, of Charlottenburg, for the continuous production of a mixed gas of uniform composition was dealt with at some length in a series of articles (constituting an abstract translation of a German paper by the inventor) which appeared in the "JOURNAL" early in 1902.* The articles dealt more particularly with the theoretical considerations on which the process was based; and we have now received from Dr. Besemfelder a communication (which has recently been published in a less complete form in the German Technical Press) giving further particulars of the advantages of the process itself. A summary of this is appended.

Recent years, especially the last one, have witnessed the publication of many communications on the worthy object of the better conversion of coal into the gaseous condition. The author, therefore, deems this a fitting opportunity to refer to his mixed-gas process, which has been patented in Great Britain (English Patent No. 13,830 of 1899) and most civilized countries, under the title (quoted from the French specification) of "Process and Apparatus for the Continuous Conversion into Gas and Bye-Products of Substances containing Carbon, so as to Obtain the Highest Possible Yield of Gas and Valuable Nitrogenous Compounds while reducing Manipulation to a Minimum." The idea has gradually impressed itself on many minds as the right one that coal should be converted at central stations completely into gas—thus avoiding the production of coke; while the fullest recovery of the bye-products hitherto obtained by carbonization should be accomplished. The gas should be of high quality, and equally applicable for lighting, heating, or the production of power. For instance, at the last meeting of the North British Association of Gas Managers, Mr. W. Young, in the course of a paper entitled "Remarks upon the Principles involved in the Production of Gases from Coal, and Suggestions as to their Application in Future Developments," drew conclusions in favour of this idea.†

He pointed out that during the carbonization of coal, as at present conducted, two-thirds of its combined nitrogen is lost. A great part of this lost nitrogen could, he said, be recovered or protected from decomposition if water gas, made from the residual coke, were passed through the retorts; the inflow of water-gas being preferably increased towards the end of the carbonization. Thus not only would the products of distillation be protected from decomposition through overheating, and probably the formation of cyanogen and carbon disulphide also be diminished, but more especially the nitrogen which would otherwise remain in the coke would be converted into ammonia and utilized. It was desirable that the coke on removal from the carbonizing retort should be brought, while still red hot, into a vertical chamber or retort placed above the water-gas generator. This chamber or retort would be heated externally by the gases which escaped from the water-gas generator during the "blow," and the water gas would be passed through the contained incandescent coke, in order to recover its nitrogen as ammonia. The coke would afterwards be discharged into the water-gas generator. The views of Mr. Young, thus paraphrazed in the *résumé* of his paper published in the "Journal für Gasbeleuchtung," illustrate the claims made by the author for his mixed-gas process, as will be seen from the subjoined abstract of them as stated in his French patent specification.

1.—The combination of distillation with complete gasification in one continuous operation; the material to be converted into gas and ash undergoing, from its introduction into the apparatus until its discharge as ash, a continuous forward movement, which is brought about mechanically, without the interposition of any controlling action depending on the operator,

2.—The continuous creation of fresh surfaces on the material, both for heating it externally and internally, and for distilling and gasifying it. The constant renewal of the surfaces is intended to accelerate distillation, to secure good conduction of heat, and to prevent the formation of lumps.

3.—The correlation of distillation and gasification by means of distributors, which provide communication between the carbonizing retorts and the water-gas generators, in such a way that the gas containing the atmospheric nitrogen, which results from blowing up the heats of the water gas generators, is kept out of the conduit which conveys the pure mixed gas to the gasholder or place of consumption. The heating power of the impure blow gases is utilized for heating externally the carbonizing retorts; while the distributor directs the water gas into these retorts. So that there is achieved concurrently the internal heating of the retorts and the intimate admixture of the water gas with the gas evolved by the distillation.

4.—The use of a distributing or downcast column as a carburetting and fixing chamber; thus, on the one hand, avoiding the heating of a separate chamber, and the usual loss of heat therefrom by radiation, and, on the other hand, rendering it possible to use carburetting agents which are not wholly vaporizable—the hot coke serving as a medium for conveying any residue therefrom into the water-gas generators.

5.—The avoidance of heating the carbonizing retorts by a direct fire, and thus an economy of from 10 to 17 per cent. of coke as compared with ordinary coal-gas manufacture, combined with the utilization of the blow gases of the water-gas generators for producing the coke required for making water gas. This coke is automatically passed into the generators while incandescent, and without coming in contact with the air. An economy of about 5 per cent. of carbon is thus achieved, without counting the gain to the water-gas manufacture through charging the generators with incandescent coke.

Claims 6, 7, and 8 are not relevant.

9.—An increase in the yield of ammonia over all other distilling and gasifying processes. The progressive and continuous moving forward of the material under treatment, and the way in which the gas circulates ensure the ammonia when once formed not being destroyed by contact with the hot walls, while the nitrogen retained by the hot coke is also recovered as ammonia; whereas this is lost in the ordinary water gas processes.

10.—The continuous production of coke, and gasification of a portion only of the distilled and carbonized material; the greater yield of gas and ammonia due to the coke being extinguished with exclusion of air, and to the utilization of the red-hot coke, while the superheated steam produced in quenching the coke traverses the cooling cylinder and converts a portion of the nitrogen retained by the coke into ammonia. Further, there is less loss of carbon, and, consequently, a greater yield of coke, owing to its being quenched with exclusion of air; while the continuous discharge of the coke results in a great saving of hand work. The process facilitates very rapid working, and thus affords a more favourable utilization of the site of the works.

A comparison of the foregoing claims, and the description of the process in Vol. LXXIX. of the "JOURNAL" (pp. 146, 207, and 276) with the *résumé* of Mr. Young's communication, will show clearly that the author's process goes even a step farther than Mr. Young's ideal, in that it avoids the contact of the red-hot coke with the air, and thus the conveying expenses and the loss of carbon by combustion. Further, it keeps the carbonizing material continually moving forward and ensures intimate contact of it with the water gas, both in the retorts and in the special distributing or downcast tower which is placed above the generators. The close agreement, however, between the aims of the author and the means to be employed for attaining them, and the ideas of Mr. Young becomes evident on comparing the account of the author's process given in the German Technical Press at the close of 1901 [and reproduced in the "JOURNAL" in January and February, 1902, *loc. cit.*], with Mr. Young's communication in the summer of 1903 already referred to.

As to Mr. Young's view that the admission of water gas should be augmented towards the close of the carbonization, it directs attention to a further great advantage which the author's process has over others. As carbonization advances, the coal automatically passes towards the source of the water gas, and thus, as the liberation of gas by distillation slackens, Mr. Young's requirement is met in the most natural manner. It has been assumed that the author's procedure gives an increased yield as ammonia of only 60 per cent. of the nitrogen which otherwise would remain in the coke. But as a certain excess of steam leaves the generator with the water gas, and thus affords a medium for further production of ammonia, it will be seen that the author's ideas on the process of the formation of ammonia are in complete accord with the views expressed by Mr. Young. Further, the gasification of tar, as mentioned by Mr. Young, is provided for by the author's process in what would appear to be an even more advantageous mode of working than Mr. Young advocated. For instance, Mr. Young would have the tar flow into an inclined red-hot retort; and the coke formed from it would be deposited on the walls, and have to be removed from time to time. In the author's method, however, the tar is sprayed into the chamber above the generators, and the coke formed is deposited on the coal, which is automatically carried down into the generators.

With reference to the quality of the gas made by the author's process, it should be observed that in his earlier communication the calorific power of the mixed gas was calculated from the

* See "JOURNAL," Vol. LXXIX., pp. 146, 207, and 276.
† *Ibid.*, Vol. LXXXIII., p. 300.

values of water gas and coal gas; and the result found was about 82 calories per cubic foot. But having regard to the effect obtained by the self-carburetting process with cold water gas, and that the carburetting in that case cannot be so perfect as in the author's process, in which it is automatically brought about by the aid of highly-heated water gas, it will be found that the calorific power of the mixed gas obtained should be about 102 calories per cubic foot, assuming that the whole of the coke produced is gasified, or 130 calories per cubic foot if the coke required for heating the carbonizers is deducted in order to show the quantity actually available for making water gas. These results entirely ignore the gain due to the suppression, by the process, of the many faults of carbonization in retorts pointed out in the earlier communications. That this gain must be considerable is evident from the results recently reported of carbonization in vertical retorts, which, in the case of the Settle-Padfield retort, show a gain in candles per ton of about 21 per cent. In this retort, however, in the later stages of carbonization the gas has to pass through a continually deepening layer of incandescent coke, which must destroy some of its illuminating constituents, which would be preserved under the author's process, in which the material is kept in continual movement.

The author's method of combining water-gas generation with carbonization so that the sensible heat of the products of the generator is utilized for reducing the consumption of fuel under the carbonizers (without any risk of contaminating the mixed gas with the poorer gases liberated from the generator), results in all those advantages which have been claimed for separate processes that have recently been described and tried being united in his process, and that, indeed, in enhanced measure.

The well-conceived Dellwik water-gas process has been cited by the author as being adapted for embodiment in his process; but it should be understood that the disadvantages of the Dellwik process in that case become greatly minimized. For instance, the sensible heat of both the water gas and the "blow" products, which is usually lost, is utilized for internal and external heating of the carbonizers. Thus, the heat, which in the Dellwik process pure and simple is lost except so far as it is taken up as heat of combination in the gas, is returned in the incandescent coke to the generators. The continuous inflow of coke also maintains the bed of fuel in the generator at an approximately constant depth. The blast is in continuous use, as one or other of the generators is always at the "blow," and, consequently, the power used to furnish the blast is utilized uninterruptedly, which is not the case with the mere Dellwik process. The hot coke cannot be blown out of the generator, because the in-takes and off-takes are at the side, and at the worst it would merely strike the top of the generator and fall back into it. The rational regulation of the rate of flow of the steam, according to the fall of temperature as gas-making proceeds in the generator, is not effected in the Dellwik process as usually worked. It can, however, be provided for quite simply, and excess of steam in the water gas avoided; thus saving the great quantities of heat unutilized in the Dellwik generator through the high specific heat of steam and the cost of producing an excess of it. The carbonizing retorts, when intended for the gasification of coal, have not the internal conveyor illustrated in the author's earlier communication,* which showed the apparatus as designed for the gasification of vinasse, or molasses residues, which becomes liquefied when heated. The coal thus escapes comminution.

In computing the cost of the author's mixed gas, the assumption was made that it would have only two-thirds the calorific power of coal gas, which is specially unfavourable in regard to its use for incandescent lighting. It was nevertheless demonstrated that the prime cost of the gas would be at the most 40 per cent. of that of coal gas on the basis of equal quantities of heat in the two gases. Then, as gas can be distributed, according to Professor C. Linde, with less loss of energy than any other source of power, it follows that the author's process affords a means by which the most advantageous utilization of fuel would be secured for town supplies and large consumers. The process also becomes of great importance in view of the considerable increase it affords in the yield of nitrogenous bye-products of gas manufacture. Professor W. Ostwald, of Leipsic, in his address to the German Association of Engineers last year,† after referring to the significance of the advent of the Welsbach mantle and the gas-engine, spoke of the telling importance to the national economy of the recovery of the nitrogen which is stored up in the coal consumed in any country, as thus the nitrogenous requirements of the soil are met without recourse to imported guano and nitrate of soda. Thanks to the Leipsic Professor also, the last objection raised by some to the manurial value of the nitrogenous bye-products of gas manufacture—viz., that ammonia is less valuable than nitrates—has been removed by the means he discovered of converting ammonia quantitatively into nitrate.

Formation of Calcium Carbide.—In the "Comptes Rendus," M. Henri Moissan describes a new mode of forming calcium carbide. By the electrolysis of fused calcium chloride—or, better still, of a mixture of fused calcium fluoride and chloride—in a graphite crucible, the metallic calcium formed combines partially with the carbon, forming calcium carbide. The yield is poor; but the observation is interesting, since the carbide is formed in this reaction at a temperature as low as 650° C.

* See "JOURNAL," Vol. LXXIX., p. 207. † *Ibid.*, Vol. LXXXV., p. 615.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Dunbar.

The Waverley Association of Gas Managers held their eighty-sixth half-yearly meeting in the Roxburghe Marine Hotel at Dunbar last Thursday. The PRESIDENT—Mr. P. Blair, of Haddington—occupied the chair; and there was a good attendance.

Provost GIBB, of Dunbar, said he considered that he and his colleague Bailie Smith were privileged beyond measure in being present at the meeting. He had no doubt that in gatherings such as this they not only enlightened outsiders, but, by associating with each other and exchanging views, they were enlightening themselves. He was delighted to extend to the Association the right hand of fellowship and of welcome to their Royal and ancient burgh; and he hoped that their visit would lead them to come back again to the old town.

Bailie SMITH said it afforded him very great pleasure indeed to support the statement made by Provost Gibb. He perhaps felt a little warmer interest in welcoming the Association to Dunbar, because he happened to be very closely connected with the gas undertaking. He had long held the convenership of the important Committee having charge of it; and it would be a great delight to him to hear the views that would be expressed at the meeting in reference to their business. He did not think they would find any small town in Scotland where more had been done in the way of introducing gas, by various methods, which had very often proved successful, but sometimes the reverse. At the present time they were in a very successful state.

PRESIDENT'S ADDRESS.

The PRESIDENT then read the following address: At our last meeting, held at Haddington, I gave you a brief description of our works; and perhaps, on this occasion, it will not be amiss if I submit a few observations on our working during last winter.

The materials which we used included 10 per cent. of first-class cannel and 1½ gallons of 90 per cent. benzol per ton of coal used, which, I have usually found, with ordinary working conditions, produces 25-candle gas. But at times during last winter, I observed it was difficult to keep the supply of gas up to this quality, even with a larger amount of benzol. I am well aware that, in severely cold weather, the gas cannot carry so much benzol vapour as in warm weather; but seeing we were only using a comparatively small quantity of benzol, I did not think we were getting it condensed in our mains, and have found no deposit in any of the drips when using such quantity of benzol.

I determined to try and find out the reason of this fall in illuminating power; and for this purpose, I fixed main thermometers at the outlet of the hydraulic main, at the outlet and inlet of the condensers, and at the outlets of both tar-extractor and scrubber. From observations of these from time to time, I found that, with the surrounding air at 40° Fahr., the temperature of the gas at the outlet of the hydraulic main was 150°, at the inlet of the condensers 130°, at the outlet of the condensers 55°, at the outlet of the tar-extractor 45°, and at the outlet of the scrubber 40° Fahr. It occurred to me that, owing to the gas being cooled to this extent, some of the hydrocarbons were being deposited in the tar-extractor and scrubber. I therefore determined to close the centre tube of the condensers; and when this was done, the temperature rose at the outlet of the condensers to 65° Fahr. I then allowed the drip from the steam-pipes to run into the tar-extractor, and fitted a small jet of steam into the scrubber. This enabled me to keep up the temperature to about 60° Fahr. at the outlet of the scrubber. With this temperature, the gas enters the purifiers at the best heat for purifying, and ensures that the impurities are taken up by the material. I certainly found that this method was beneficial, both for keeping up the quality and also in assisting the purifiers in their work. I believe also that the hydrocarbons which, with the greater cold, were deposited, were carried forward and travelled with the benzol vapour, and so kept up the candle power of the gas in the district.

I may mention that, at the beginning of the winter, I was working with a tar carburettor that I had fitted up in the main flue, so that the heat of the waste gases in the latter vaporized the lighter oils, and they passed on with the gas. I was also passing 2 per cent. of air through it, and then into the hydraulic main. It worked quite satisfactorily so long as the temperature was about 200°; but as the season went on, and more retorts were required, the temperature was increased to over 500°, with the result that all the naphthalene in the tar was carried forward and deposited in the purifiers, and it also reduced the quality of the gas. Having no means of regulating the temperature of the carburettor, I had to stop using it and change all the purifiers, so as to get rid of the naphthalene which had been deposited there. I have not been working with the altered conditions long enough to compare the saving in cost with them, against those formerly in use; but I can see that I am getting better results all round, while I have not had to change any purifiers since adopting them.

The accumulation of carbon on the retorts, though not so troublesome as formerly, still has to be removed. With glazed retorts, water-seal in the hydraulic main, and the exhauster kept running at a level gauge, the retorts now only require scurfing about once every six months. There has lately been placed on

the market the Meldrum retort scurfer.* This consists of a steam-jet blower, properly proportioned to its work, connected by a metallic steam tube; and it can be applied to any retort in the setting. To the scurfer is fixed a piece of 1½-inch wrought-iron tube, long enough to enter about two-thirds into the retort. Having a 1-inch steam-pipe along the top of the retort-bench, I had a scurfer on approval; and the retorts tried had been working for six months without being scurfed. When the scurfer was taken out, the carbon at the back of the retort was lying on the bottom of the retort. The time taken from the drawing of the retort until it was charged again, was an hour; while the heat was improved, and no leaks were observed from the retort. It is the handiest appliance that I have used for this purpose.

Discussion.

Mr. H. O'Connor (Edinburgh) said they had listened to a very interesting address. There were a large number of points in it which might be specially noted. The first he commented upon was the taking of the temperatures at the various parts of the works. The facts given were very interesting and very instructive. In many small works there were none of these thermometers fixed to enable the manager to find out the temperature at the various parts, and to correct excessive or insufficient temperatures. And so, in these figures, they had facts given them which were worth noting and remembering. Those of them who were at Haddington last year, saw the tar-carburettor in use which the President had designed for himself; and he (Mr. O'Connor) thought it would be interesting to know whether the 2 per cent. of air which was being passed through was extra to that used for the renovation of the oxide in the purifiers. They might well expect the naphthalene would be driven off at the high temperature. The President, they knew, had a draught gauge in the chimney of his works. He would like to ask him whether he noticed any difference in the draught of the chimney when he was getting a temperature of 500° in the carburettor from what it was when he was getting 200°. The fact that his retorts only required scurfing about once every six months showed that the President had taken very great care in the various matters which helped to prevent the deposition of carbon. He mentioned three of them which were of great importance. First, there was the glazing of the retorts. This, perhaps, did not prevent the deposition of carbon so much as assist in its removal when deposited. Then there was the water seal in the hydraulic main, which reduced the pressure in the retorts. The tar had been removed; so that he was not washing the gas with tar and thereby withdrawing the hydrocarbons from it. Then he spoke of keeping the exhauster running at a level gauge. There was nothing that deposited carbon on the side of a retort so much as oscillation in the retort itself, which caused a variation in the flow of the gases, and the gas, instead of passing easily away, was waved backwards and forwards in the retort—the hydrocarbons being converted into solid carbon, and being thereby not only removed from the gas, but deposited on the retort, which prevented the heat passing into it. The President had therefore been taking considerable care to see that all the points that required noting had been noted and carefully attended to. He had not seen the scurfer referred to; but he could quite understand that, with a properly regulated injector, there would not be an excess of moisture in the steam that was sending the air into the retort, and consequently there would not be that very rapid change of temperature inside which might cause cracks. At the same time, he would like to caution anybody who might use the apparatus not to put it into a retort and go away and forget it, because, if he came back several hours afterwards he might find cracks. But, if it were watched, it might be a very admirable apparatus.

Mr. A. Bell, sen. (Dalkeith), congratulated the President upon being up-to-date in trying to adapt and adopt all that was likely to increase the revenue. In small gas-works, unfortunately, managers had so many other duties to attend to that they could not give much attention to the retort-house. But this was really where the money was made; and the President was to be congratulated upon the efforts he was putting forth in this way. Unfortunately, he (Mr. Bell) was not at Haddington, and did not see the President's works; but, from what Mr. O'Connor had said, they seemed to be very much up-to-date. Mr. O'Connor said the glazing had not much to do with the stopping of the carbon. It had almost everything to do with it. Fire-clay retorts were porous, and hydrogen, being a thin gas, passed through them—the carbon being sifted out as it passed through. But when a retort was glazed, there were not those pores for it to get into. As to the Meldrum scurfer, he presumed that by the injecting of air and steam, a tremendous heat was got up—so high, in fact, as to decompose the steam—and a shrinkage took place, which was what brought down the carbon. They would see there was a double action in the glazing of the retorts; they not only saved the breaking up, and the consequent lowering of the illuminating power of the gas, but the carbon could be taken off without destroying the retorts. Mr. O'Connor was quite right in what he said regarding the temperature. They could not have too many thermometers about their works, because the illuminating power of the gas depended greatly upon the condensation. If they were dealing with a simple gas, it would be an easy matter; but they had to deal with a compound gas. There were any number of them, each having its own vapour tension. Whenever the temperature got low, the tar took up all the heavy hydrocarbons. Let them keep the temperature above the vapour tension, and the hydrocarbons would travel any distance without condensation. But bring it down a degree or two below that, and then the hydrocarbons were absorbed and lost. This was his fear in using benzol. Their Scotch climate was a very tricky one, and their mains were shallow, and would not carry. They certainly would not carry benzol vapour, which was a mechanical and not a gaseous mixture. A few days previously, his holder being full, he tried to see what condensation he had on the surface. He found he had ¾ inch of a very fine pale Bass's ale. This was during a time of intense frost. Whenever they had two or three days of sunshine, the whole of this was gone; but it was at the expense of the other days of the low temperature. That was his fear as regarded benzol. He was sure the President's address was admirable, and on the right lines, for small works especially, because they could not have too much knowledge of the different parts of the apparatus they worked with.

Mr. W. Blair (Helensburgh) acquiesced in what Mr. O'Connor and Mr. Bell had said. He did not know that in the removal of the deposit of carbon from retorts very much importance was to be attached to the glazing of the retorts. A great deal depended upon the pressure—in fact, the most part of it depended on the pressure at which the hydraulic seal and dip-pipes were working. The greater the pressure, the greater the deposit of carbon. He had tried Meldrum's blower years ago—not, perhaps, fitted so nicely for the supply of steam and air; and he found it a great advantage. The steam was used to force the atmospheric air into the retort; and this increased the heat, causing the carbon to give way and to fall down. In works where they had steam, the steam applied in the proportion used in the Meldrum arrangement would be found to be the best. The keeping up of the temperature of their gases was a subject which was not given the consideration and attention that it ought to have. Gas should be maintained, and carried through the whole of the apparatus, even till after it had passed the purifiers, at a temperature as near to 60° as possible. If kept at this temperature, the liquid hydrocarbons that were in the gas would not be condensed and absorbed by the tars in the course of friction; and this also increased the mechanical action of the lime, and allowed it to do the work for which they employed it. There was no doubt that a falling temperature did affect the carrying quality of gas from benzol; but it did this with all high qualities of gas—it did not matter whether it was made from shale or from high-class cannel. It might, however, be that it did so to a more pronounced extent with benzol. He had to send his gas 6½ miles along the sea-shore; and his mains were not very deep. There was a slight deterioration; but he did not know that it was any greater than would be the case if he were using cannel coal. He had been working with from 1½ to 2 gallons of benzol; and he had not lifted a gallon of condensation from his mains in two years. His unaccounted-for gas had been reduced 9 per cent.; so that it did not look as if there was a great deal of condensation taking place. He considered the address was on right lines, and lines which they should all study for themselves.

Mr. T. O'Neill (Dunbar) said the only point he had taken notice of in the President's address was where he said that, after leaving his retorts off for about an hour, there were no cracks in them. If, after working a bench of retorts for six months or more, keeping up a fair temperature, there were no cracks in them, that beat all his experience. He had cleaned hundreds of retorts, and had always found cracks in them. He had seen various modes of cleaning; and he thought that of all methods the old-fashioned one of simply leaving the retort off for a few hours, and burning the carbon off, was the best, provided they had good bars, and a good knowledge of how to use them. As to enrichment by benzol, he had had no practical experience of it; but he thought, from the tone of the President's address, that he appeared to be not so much in love with the process as he used to be. He thought that where benzol had been resorted to, there were a great many complaints as to the quality of the gas. There was no doubt about this. If they took the works which had gone in for enriching with cannel alone, there seemed to be an absence of these complaints. Where benzol had been used, not only in small works, but in all the works in Scotland where it had been used, there had been common complaints as to the quality of the gas; and there was no doubt that these must be due to the employment of benzol. Mr Blair, of Helensburgh, thought there was no more condensation in the case of gas made from benzol than in gas made from cannel and shale. He thought this was a mistake. But apart from that, condensation from benzol would have nothing to do with unaccounted-for gas, because there was no increased volume of gas from the use of benzol, and therefore they could have no loss in unaccounted-for gas.

Mr. J. Tulloch (Loanhead) thought they might have any amount of discussion upon the excellent address of the President. Condensation was a thing which did not take place in the works only. If they could keep their gas at the temperature at which they sent it away from the works till it reached the consumer, he had not the least doubt but that they would all benefit. They could take the temperature from the end of the condensers till the gas went into the holder; but it was impossible to keep it at the same temperature when it went out to the streets. Everyone knew that in summer they could make better gas with inferior

* See "Journal" for Feb. 2 last, p. 274.

coal than they could in winter when the temperature was low. As to carbon, he had advocated long ago the method of getting rid of it mentioned by Mr. O'Neill; and he had never seen a better one. It was the easiest way for the retorts, and also for the men, to let the carbon burn off, provided they had time to do it. But when they were pressed, it was sometimes not easy to get time. But if a retort which had worked for any considerable period were struck, and allowed to stand off for half-an-hour, they would find, when they went back to it, that the carbon was gone. So he thought the most economical way of working a retort was to keep it going as hard as possible. There was a fortune for anyone who could make a paste that could be put on the retorts when they were cleaned, in order to keep the carbon from entering the pores. Glazed retorts were therefore a great advantage to anyone making gas.

The PRESIDENT, replying to Mr. O'Connor, said the 2 per cent. of air he used was the total. In regard to chimney draught, he widened his chimney so that it would not obstruct the draught. That had no effect upon it. Mr. O'Neill said there were more complaints about the quality of gas where benzol was employed. He held that there were not, and that there had been more where it was not employed. It all depended on the quantity of benzol, which should be used in moderation. Where they were making 25-candle gas, he held that they must use a little first-class cannel; and from 1½ to 2 gallons of benzol would be quite sufficient. In regard to scurfing a retort, he thought that anyone who had ever used Meldrum's arrangement would never employ any other. If they simply burned off the carbon, and dug it out with the bar, the cracks were opened up, and they lost the first, and perhaps the second, charge. He could have cleaned out his retorts in half-an-hour; but he took an hour to do them, and the heat was better than before. After charging he examined all the flues, and could not detect any leakage.

Mr. H. RUTHERFORD (Aberlady) proposed that Mr. J. Gemmell (Melrose) be elected President for the ensuing year, seeing that the Association were to meet in Melrose in September.

Mr. W. BLAIR seconded the motion; and it was agreed to.

Mr. GEMMELL having returned thanks for his election,

Mr. A. BELL moved that Mr. W. Young (Penicuik) be re-elected Hon. Secretary.

Mr. TULLOCH seconded the motion, which was carried.

Mr. RUTHERFORD then presented the President with the medal of the Association; and he returned thanks.

After the meeting, the members and friends, to the number of about forty, dined together in the hotel—Mr. Gemmell in the chair. The company included Provost Gibb and Bailie Smith, both of whom delivered interesting historical speeches. The usual toasts were duly honoured.

NEW ENGLAND ASSOCIATION OF GAS MANAGERS.

(*Continued from p.* 846.)

Inclined Retorts.

The two papers by Mr. C. H. Gifford and Mr. C. F. Prichard (Vol. LXXXV., p. 624) were discussed together.

Mr. Bradley started some inclines last Midsummer, and for weeks they went on so well that he really thought there was not much trouble about inclines. But suddenly they developed various peculiarities that were not overcome without a great deal of work. They were now going on nicely; and the difficulties were similar to those indicated by Mr. Prichard. In starting the benches, considerable care must be exercised to avoid explosion. He charged the generators lightly, got the heats up so that the outlet nostrils were red hot, and then filled the generator above the take-off. At first he worked four-hour charges, but found these did not burn off properly. He then tried five hour, and finally came down to six hour for the bottom retorts and four hour for the remainder. He was putting in 1000 lbs. of coal per charge; and Mr. Prichard used 950 lbs. He obtained a little more gas per bench than Mr. Prichard. He averaged 65,000 feet per man, 4·9 feet per pound of coal, candle power and yield of residuals the same as with horizontals. So the saving was entirely on labour. Counting all the retort-house men, there were 22½ employed for twenty-four hours. The heat near the bottom mouthpiece should not be greater than the remainder, or troublesome chokes would ensue. The carbon deposited near the mouthpiece was easily removed by scraping at each charge; and it was only necessary to lay off the retort for cleaning about once in 21 days. As to the varied accounts about the slipping of coal in the retort, all coal would slip if improperly used, and no coal would slip if properly worked. It was a question of running heats high enough to take the maximum charge. With retorts of the size he used, this might be 800 lbs.; and with such a charge there would be no slip. But reduce the charge to 400 lbs., and it would always slip. His retorts were 18 ft. long and 16 in. by 24 in. in section; and the setting was the Didier-Stettiner. During the month of January, he made nearly 36 million cubic feet of gas from 54 retorts, which averaged out 77,380 feet per man, 21,360 feet per retort, and 4·8 feet per pound of coal. The fuel consumption was some 15 lbs. of coke per 100 lbs. of coal carbonized. He purified with oxide entirely. The retort-house labour included two foremen, four men on the charging floor, eight on the discharging floor, one at the furnaces, one at the hydraulic mains, and six at the coke. The coal was delivered by machinery; and he intended to deal with the coke in the same way. In concluding, he spoke highly of the De Brouwer charging machine for horizontal retorts, one of which he had in operation at New York.

Mr. F. Egner described three patents by Mr. W. R. Herring, relating respectively to the charging, drawing, and measurement of coal, and said that Mr. Bredel, of Milwaukee, had also invented a device for weighing the coal charged into each retort. He brought forward the advantage of inclined retorts ten years ago, and was glad to find that the figures he then produced were corroborated to-day. Mr. Norris understood that in England the inclined retort was credited with a slight falling off in candle power as compared with horizontals. Mr. Shelton asked for some further particulars as to the crushing of coal, as Mr. Gifford spoke of large coal going to the extreme end of the retort, and small coal not going down far enough. But he understood that crushing machinery was provided for the purpose of getting uniform size. He was trying an experiment on a smaller and cheaper scale than was usual with inclined retorts, dispensing with lofty buildings and other costly items. It comprised three beds of sixes, with retorts 12 ft. 6 in. long. Mr. Russell, following the last speaker, gave some further details of the beds of sixes. The arches were 8 ft. 6 in. wide, and the furnaces half-depth regenerators. The front and back stays were 12 inches, and the end stays 15 inches wide; and the coal-bin was supported on the stays and projected through the roof, forming a sort of tower. The producers were external, 5 ft. 6 in. diameter, with steel shells. He believed in tying the arches strongly, and that more substantial bracing was needed for inclines than for horizontals. The cost would be about double that of horizontals; but a larger installation could be provided at a much cheaper rate. External producers were working satisfactorily at the Old Kent Road works of the South Metropolitan Company, London.

Mr. Anderson said, as to crushing coal, the greatest trouble was to get lumps to break. A mixture of 3-inch lumps with a fair amount of slack would work all right; and if the coal was finer than usual, the men soon learned that they must give it a little more impetus. He could obtain any heat he required with his settings, and regulate it in an hour or two. The best way of controlling the heats was by means of the secondary air. His retorts were in good condition after eight months' work; and he believed they would run for 2 years and 6 months. Mr. Allyn said the durability of inclined retorts was an important point. He did not think they could be patched or repaired nearly so readily as horizontals. Mr. Barnum referred to a coke-conveyor at Worcester, which dealt with the coke in parcels of 24 bushels each, instead of dividing it up in small troughs or pockets, and thus avoided making breeze and small. The bucket was carried by a carriage running on overhead rails. The contents could be dropped wherever required, and therefore need not be handled a second time. The same apparatus could also be used for ashes or clinker. It was controlled by one man; and the time occupied from striking the lids to the delivery of the coke where required, including quenching, was six minutes. Mr. Bredel said that, in putting down expensive machinery, it was well to remember that it should do a good working day.

A machine idle for 75 per cent. of the time cost nearly as much for maintenance as one in active work. Mr. Ramsdell thought the inclined system cost 5 to 25 per cent. more than the horizontal, and the larger the installation the less the additional cost.

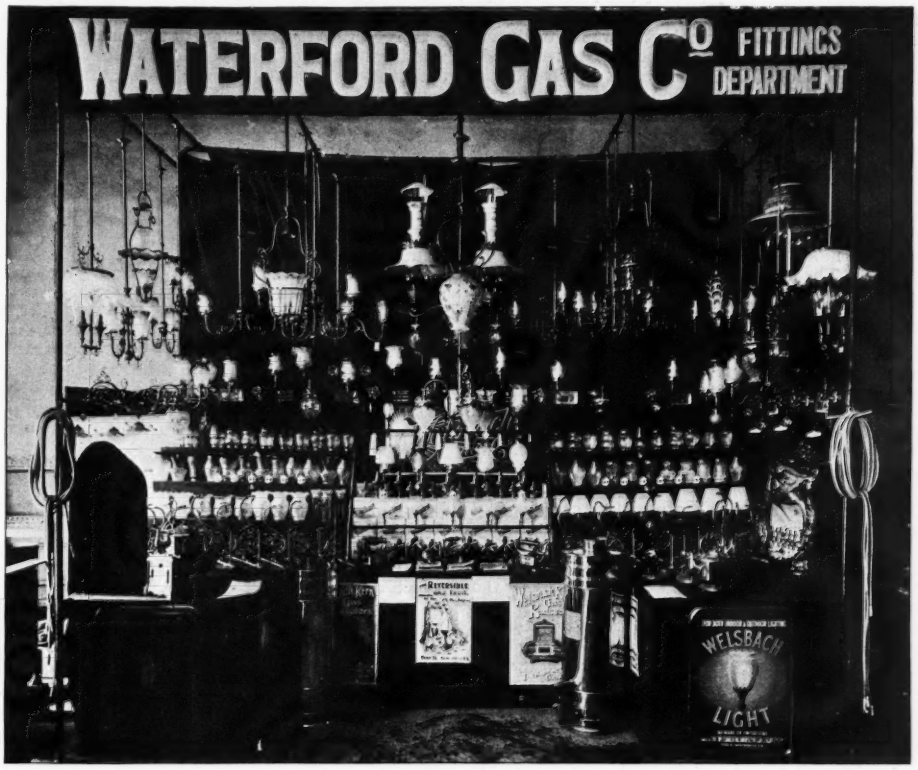
Mr. Gifford replied, and said that he was making 14½-candle gas, purified entirely with oxide, and averaged 5 feet per pound of coal carbonized. The retorts were set at an angle of 32°. Six men did all the retort-house work, including bringing in coal, taking out coke, looking after standpipes, furnaces, &c.

Mr. Prichard also replied. He did not find there was any loss of illuminating power with inclined retorts. He used chiefly oxide for purifying; and the retorts were set at 32°. His labour figures included everything, from coal pile to coke pile. With ten men—five on each gang—and two days only, to look after standpipes, hydraulic, &c., he had made over 900,000 cubic feet per day. The general standard was one man per bench per shift. Eight benches would require eight men per shift. He had not been very closely into the cost of power; but it was not an important item. He had read that settings of nines were not satisfactory; but this did not accord with his experience. He found no trouble with such settings. He invited the members present to call at Lynn and see the settings at work.

(*To be continued.*)

A GOOD EXAMPLE OF AN EXHIBITION STAND.

It is not every shopman who is a good window-dresser; and it is not—many an exhibition visited has made plain—every gasman who is a good hand at setting out to the best advantage exhibition stands. It requires a large amount of skill and judgment to decide how the most may be made of the space, and how to dispose of the goods so that every example may be inspected, and, in the case of lights, so that their efficiency may be fairly tested



by the eye without impediment. Very often, particularly on stands devoted to lighting, the numerous exhibits, packed in without appreciation of orderly or effective arrangement, present to the eye an awful medley.

A very good type of stand and display of gas fittings and appliances was to be seen at the Trades and Commerce Exhibition held at the end of last month in the Town Hall at Waterford; and a photograph of it has been sent to us by Mr. J. G. Tooms, the Manager of the local Gas Company. The exhibition was promoted by a Syndicate of English business houses, who have projected a visit to all the principal towns in Ireland. The Gas Company took space for a stand just the same as any other trader; and they have derived considerable benefit from it. The first thing that will strike the observer is the completeness of the stand. There appears to be everything there from a gas-iron to a cooker, every article required for lighting from a plain bracket to high-power lamps, together with heating appliances of various kinds. Whoever was responsible for the arrangement of the goods did his work very well indeed. There is a decorative appearance about the stand that courts attention; and the eye having been captured, it is seen that every article is excellently placed for a clear view. There is no necessity for a list, or an explanation of the character, of the goods shown. Their description is imparted far more succinctly in the photograph than it could be in words.

Regarding the conduct of the exhibition, Mr. Tooms tells us that he had three assistants at the stand, explaining the uses and duties of gas-irons, geysers, incandescent burners, lamps, &c., as well as advocating the Company's maintenance system, which is carried on at a charge of 2s. per burner per annum. We do not know what the 2s. includes, but 2d. per month would be cheap for the special labour alone. Different nights were given up to distinct classes of lighting. One night, shop lamps were shown; typical high-power lamps were the feature of another evening; artistic indoor lights (inverted and other types) claimed attention on a third; and ordinary slot installation lights on a further occasion demonstrated what could be done by them—each display being duly advertised in the local papers and in other ways. The attendants at the stand made a strong point of explaining to as many visitors as possible as much as they could in the time available about the Company's commodity. The sale of the articles on view was quite a secondary consideration; the opportunity being better used by pressing home a few wholesome truths about gas and its capabilities. There is no competition yet in Waterford; but the Company are wisely taking Time by the forelock, and are looking after business and their customers' interests just as ardently as if the fiercest competition were in progress. That is how things should be. The reward of such zeal will be more distinctly realized when (if ever) the electrical competitor steps into the field. Should he ever determine that he will come, he at all events will quickly learn something as to the character of the fortification work upon which the Gas Company's Manager and his staff have been engaged.

THE MOTION OF GASES IN PIPES, AND THE USE OF GAUGES TO DETERMINE THE DELIVERY.

The paper read at the recent annual general meeting of the Institution of Mechanical Engineers was by Mr. RICHARD THRELFALL, F.R.S., of Birmingham. It was titled as above; and into his subject the author went at considerable detail. The paper itself, with the tabular matter, covered nearly 27 pages of print; while five appendices occupied nearly an equal number of pages. The contribution was of a highly scientific character; and this fact, together with its length, precludes such a digest of its contents as we should prefer to make.

The account of the investigations which formed the principal part of the paper was prefaced by a statement of the hydro-dynamic principles involved, in order that what followed might "be free from ambiguity." In the discussion on the paper, Professor Unwin, referring to this preliminary matter, expressed the opinion that the author had here encumbered himself with a number of irrelevant considerations; and some of his statements were curiously doubtful. He gave an instance, as will be seen in the discussion. This part of the paper must be passed over, until the portion is reached where the author states the points embraced in his investigation. These were: (1) The construction of a suitable manometer for observing the small differences of pressure to be dealt with. (2) The investigation of the influence of the shape of the Pitot gauge-tip on the pressure set up. (3) The investigation of the reliability of side-gauges. (4) The relation between the velocity of air currents and the pressure developed in Pitot and other gauges. (5) An investigation of the distribution of velocity of gas streams in pipes. (6) An investigation of the distribution of velocity considered as a function of the velocity itself, and a comparison of the results obtained when measuring streams for delivery by the Pitot tube, with the actual volume of gas delivered as measured by a gasholder. (7) Some applications of the results obtained to actual engineering problems, including an account of a new system of inferential gas-meters. Into all these points we cannot go with the author, but the following extracts have been made as being of most general interest.

In the experiments, an apparatus, consisting of a pipe about 109 feet long by 21 inches internal diameter, of thin iron-tubing, was set up. A fan driven by an engine was employed to produce air-streams of various velocities in this pipe. The speed of the engine was kept constant by hand; and observations were repeated as often as was necessary to eliminate irregularities in the driving.

The Mode of Motion of the Gas-Stream.—It is generally assumed in practice that currents of gas in pipes are in turbulent motion, at all events for velocities of engineering importance. It seemed to the author desirable to obtain some definite information on

this point, before endeavouring to interpret the results of the measurements made by observing the smoke of small explosions. For this purpose, a gentle stream of smoky air was introduced in the main stream of the experimental pipe above described. The smoke employed was phosphorous pentoxide, which gives a very persistent fume, and is easily produced by placing a little burning phosphorus on the bottom of a small tin canister, through which the air is driven on its way to the main stream. The smoky air was cooled down on its way to the experimental pipe, and was led into the main stream by means of a sort of facing-gauge; but in this case facing down-stream. The inlet was about 12 feet from the delivery end of the experimental pipe. The progress of the mixing of the smoky air with the rest of the stream could be observed through some holes in the side of the pipe, and by looking in at the open end. The large diameter of the pipe (22 inches) was of service in this connection.

It was found that the smoke emerged from the pipe as a stream about 15 inches in diameter when the fan made 140 revolutions per minute. The air current was varied from this point to a velocity corresponding to the lowest velocity observed; but in all cases the smoke came through in a thick column. Since this only required a length of 12 feet, it is clear that, in interpreting the velocity experiments made on over 100 feet of pipe length, it is safe to regard the smoke produced by the explosion and the air as being thoroughly mixed up.

Interpretation of Velocity Experiments.—At the moment of explosion, the smoke is distributed in a more or less symmetrical manner across the pipe section, so as to form a plug of smoky air filling a certain length of pipe. In the case of viscous flow, as this plug passes along, it gets drawn out at the central part, becoming cigar-shaped in front, so that by the time it reaches the open end of the pipe it forms a hollow shell. The turbulence of the stream examined, however, intervenes to equalize the motions of the various smoke particles, so that what is seen at the open end of the pipe is a thin leading stream in the centre, quickly broadening to an apparently solid cloud, and ending in some whisps of smoke clinging to the sides of the pipe.

It has been assumed that the leading stream consists of those particles which have not deviated appreciably from a central path, and therefore fairly represent the average velocity of the central filaments. Similarly the final trace of smoke represents the motion of the air close to the walls of the pipe. It is estimated that about one-thousandth part of the smoke which is actually employed could not possibly escape detection; and if the distribution of the velocities of the smoke particles be regarded as subject to the law of distribution of errors, it appears that there is every reason to suppose the above assumptions are approximately correct.

On the Distribution of Velocity Across a Pipe Section.—It has been shown by Darcy that in the case of water flowing through a long smooth pipe, there exists a circle whose radius is 0·689 of the radius of the pipe, which circle is the *locus* of points through which the stream has the mean velocity. The mean velocity is defined as that velocity which, when multiplied by the area of the section of the pipe, will give the delivery. It has hitherto been usual to apply this result of Darcy's to the flow of gases generally, without investigating whether the condition stipulated as to length of pipe is sufficiently satisfied.

It may be stated at once that, in dealing with ordinary currents of air or gas, as occurring in every-day practice, the condition as to length, or some other condition, is not satisfied; and it becomes necessary to investigate the distribution of velocity for each particular case as it arises. Assuming that this has been done in any particular case, the further question arises as to whether the distribution of velocity remains similar to itself as the velocity varies; for, unless this is the case, the whole system of gauging by the Pitot tube would be, for metering purposes, without any practical significance.

The author's experiments on this subject have now extended over more than two years; and the result is unmistakable—viz., that within the range of velocities that have been examined, extending from 600 to 3500 feet per minute, the distribution of velocity is not a function of the velocity itself, not even in those cases in which it is very irregular and widely different from the ideal distribution as formulated by Darcy. Some of the experiments were made with currents of air supplied by a fan driven electrically; others by timing the fall of a gasholder of about 22,000 cubic feet capacity—the latter, of course, having the advantage of supplying air or gas at a known rate, and thus giving a complete control of the whole gauging.

In regard to the investigations made by means of a fan, the great difficulty lies in securing uniformity of driving. A great deal can be done by the observer having electric measuring instruments under his eye, and regulating resistances under his hand. But the most satisfactory method of all is to employ a subsidiary Pitot tube and side-gauge in connection with a delicate manometer. Practically the same experimental conditions as those used by Darcy were employed throughout the investigation. A steel tube about ¼-inch diameter was provided at the centre of its length with a small mouthpiece at right angles to its axis, so that, when it was placed across an air stream, the mouthpiece faced the stream, and could be moved to any point in a diameter of the pipe under investigation. Suitable scales were placed in position outside the pipe; so that the situation of the mouthpiece could be accurately ascertained at any time. The side-gauge was sometimes used in the form of a flanged gauge, and sometimes as a simple opening into the pipe as already described.

In regard to the reduction of the observations, the usual course was to gauge right across one or two diameters of the pipe, taking observations most frequently as the Pitot tube approached the walls of the pipe. The delivery of the pipe was ascertained by breaking up the section into a sufficient number of shells, finding the mean velocity for each shell from the curve, and then computing its delivery. As the distributions were often irregular, this was practically the only way; and it was found that in general it was amply sufficient to sum about 15 shells in order to obtain a result within less than 1 per cent. of the true value. The number of shells necessary, of course, depended on the form of the distri bution curve.

An inspection of the tables given by the author he believes justifies the following propositions.

(1.) The radius of the circle of mean velocity is about 0·775 of the radius of the pipe through which gas is flowing, in the case of pipes which are not infinitely long but comparable in length with those employed in connection with gas-producer plants.

(2.) One case of a gas-main 15·75 inches in diameter was examined at a distance of about 10 yards from the nearest bend. In this pipe, the radius of mean velocity was certainly about 0·9 of the radius of the pipe.

(3.) In no case was a radius of mean velocity so low as 0·689 actually found.

(4.) Whatever the distribution of velocity observed at any one velocity may be, this persists unaltered through a wide range of velocity covering the cases which occur in ordinary practice. The highest velocity examined was 3600 feet per minute; the lowest for which accurate results were obtained about 600 feet per minute.

(5.) The ratio of mean to maximum velocity is unexpectedly constant over a wide range of velocity and a very varied mode of distribution. The average value is about 0·873.

(6.) Since in any practical case, where accuracy is necessary, a calibration of the pipe for distribution of velocity must be made, it is immaterial where the Pitot tube is placed. Since, however, the velocity is in general greatest at the centre, it is convenient to place the tube mouthpiece at this point. If it be considered sufficient to dispense with a calibration, then the results indicate that it is better to place the Pitot mouthpiece on the circle of radius 0·775 (radius of pipe) than to place it at the centre, and to assume a ratio of mean to maximum velocity of 0·873.

The Delivery of Producer Gas by Large Mains.

The whole investigation was directed to elucidate the problem of how best to measure the delivery of producer gas by large mains. It was, therefore, considered that a series of comparisons of delivery, as deduced from Pitot tube readings, with the same quantity as measured by a gasholder, would be desirable. A 6-inch iron pipe was taken and calibrated, and six experiments were made by allowing a gasholder to empty itself through the pipe. The table is intended to show the sort of accuracy attainable in ordinary everyday practice, as well as the degree of consistency that may be looked for in a series of measurements of this kind.

Some Applications of the Measurement of Air and Gases in Practical Engineering Work.—The first application is, of course, to the measurement of producer gas, and, indeed, the whole investigation was directed to this end. As soon as it was firmly established that a Pitot tube in an invariable position could give an accurate measurement of the delivery, a hope arose that an apparatus might be constructed which would give a time integration of the square root of the Pitot tube-pressure, and hence of the delivery over any period of time. This amounts to making a gas-meter working by Pitot tube-pressure. The problem has been solved in many ways, some of the resulting mechanisms being described in British Patent No. 21,312 of 1902. The instrument which has had the longest trial (eighteen months) in actual work is selected here for description, because it has shown itself reliable over the whole of the period, and may be considered to have reached a stable form.

The principle employed is the following: The Pitot tube and side-gauges being placed in a calibrated gas-main, a small pressure difference is set up. This pressure difference is brought to bear on a bell, which is hung and tied down by springs and partially immersed in oil like an ordinary gasholder. The tubes are so connected that the pressure difference tends to depress the bell. The force acting on the bell is continuously balanced electrodynamically by an arrangement of six coils of wire—four fixed and two movable—carrying a current, and so attracting and repelling each other. By the construction of the meter, the current is self-adjusting, so that the pressure difference is always exactly balanced by the electrodynamic force.

Let C be the current, P the pressure difference in any units, A the area of the section of the bell, and K a constant. Then, when the balance is exact

$$PA = KC^2; \text{ or } P = C^2 \times \text{constant} \quad (2).$$

It has already been seen, however, that, with a properly calibrated gas-pipe, the rate of delivery of gas ($\dot{D}$) at any instant is

$$\dot{D} = \sqrt{P} \times \text{constant, or } P = \frac{\dot{D}^2}{k} \quad (4).$$

Comparing (2) and (4)—$\dot{D} = C \times$ constant (5).

Observations of the Measured Delivery from the Gasholder through a 6-inch Pipe by Pitot Tube Measurement of the Maximum Velocity of Flow at the Centre of the Pipe. The average ascertained value of Ratio of Mean to Maximum Velocity—viz., 0·8038—is used throughout. The Maximum Velocity is obtained from the Formula :

$$\text{Velocity in Centimètres per Second} = 1{\cdot}377\sqrt{\frac{98{\cdot}12 \times \text{pressure in mm. water}}{\text{density of air}}}$$

No.	Distance of Fall of Holder. Feet.	Time of Fall of Holder. Minutes.	Total Air Delivered by Holder. Cubic Feet.	Average of all Observations at centre of 6-inch Pipe for Pressure in mm. of Water made during One Fall of Holder.	$\sqrt{\text{Pressure Difference in mm. of Water.}}$	Density of Air : Grammes per Cubic Centimètre.	Maximum Velocity by Pitot Tube. Feet per Minute.	Total Gas Delivered by Holder —by Gauge Observations.	Error of Gauge Estimate as Percentage of True Delivery.
1	6·0	9·033	1881·3	2·86	1·691	0·001251	1284·0	1830	2·73 (Low)
2	6·687	5·250	2096·0	11·91	3·451	0·001275	2594·4	2149	2·53 (High)
3	6·0	4·166	1881·0	14·22	3·771	0 001275	2835·0	1864	0·9 (Low)
4	6·0	4·750	1881·0	10·68	3·268	0·001264	2468·4	1850	1·65 (Low)
5	6·0	4·905	1881·0	9·83	3·137	0·001261	2370·6	1834	2·5 (Low)
6	6·0	4·960	1881·0	9·872	3·142	0·001261	2374·8	1859	1·17 (Low)

NOTE.—In series 6, a wider Pitot tube was employed. Average error 1·38 per cent. low. This may be regarded as a systematic error.

The delivery over a period of time T in any units is—

$$\int_0^T \dot{D}\, dt = \chi \int_0^T C.\, dt.,$$ where χ is a constant.

Now if the current flows through an ampère-hour meter, this instrument gives us the value of $\int_0^T C.\, dt.$, and hence, when χ is known, the number of cubic feet or cubic metres of gas delivered can be found from the reading of the ampère-hour meter.

To calibrate the meter, it is only necessary to know the area of the cross section of the bell and the current required to balance any particular pressure difference. Of course, the distribution curve of the pipe where the Pitot tube is placed must also be known; and the mean density of the gas where it passes the Pitot tube. All these quantities are obtained once and for all.

In the discussion, it was stated by Dr. Glazebrook that the Pitot tube had been, during the past eighteen months, the subject of investigation at the National Physical Laboratory; and the results there confirmed the conclusions of Mr. Threlfall. The agreement in results showed that the method of measuring velocities by his tube, up to about 3000 feet per minute, was one that might safely be adopted. He emphasized the fact that the tube could, for many purposes, be used most satisfactorily. Professor Unwin contributed to the discussion, giving an outline account of the vast amount of work that has been accomplished by the Pitot tube. Regarding the point as to some of the statements in the earlier part of the paper being curiously doubtful (which part is omitted in the foregoing), the instance Professor Unwin gave was the author's statement (see Mr. Threlfall's reply, below) that the theory of the momentum of the stream against the mouth of the Pitot tube involved the annihilation of the gas. He further understood the author to say that, in practice, the gas could not be annihilated when it came to rest—it had to be pushed out sideways; and the force to do this must come from the gas itself. When, said Professor Unwin, a current struck a plane, it was bent sideways. In the case of a jet striking a plane, the whole pressure on the plane was the pressure due to twice the velocity of the head; but the pressure at the centre of the jet would be only the velocity head itself. A little later in his remarks, the Professor suggested the possibility of using a meter of the Venturi type for measuring air. He thought this would be the simplest form of air-meter possible. The objection might be raised that, if the stream were contracted, some of the pressure head would be wasted. This would be so; but the amount lost would be practically negligible if the pipe were properly formed with a sufficiently gradual curvature. As to the measurement of producer gas, the Pitot tube, he asserted, could not be used unless the density of the gas were known; and producer gas, as engineers were mostly well aware, varied in its composition. Welcome was given by Mr. Henry Lea to Mr. Threlfall's confirmation of the accuracy of the Pitot tube. Its simplicity left nothing to be desired. The indications, however, were of so minute a character that, unless accurate measurements were taken, the results were not likely to be of very much value—anyway, in the measuring of the flow of gases. The author's communication, for this reason, was especially welcome, seeing that it afforded a means of measuring the indications of the tube with great accuracy.

In his reply, Mr. Threlfall regarded the suggestion that the Venturi meter might be used for the measurement of gas as a good one; there was little doubt that it might be made to answer. The difficulty, however, that he saw was that, when a large gas-main had been laid, manufacturers were not inclined to go to the expense that would be necessary for the application. He could not understand how he had given Professor Unwin the idea that the gas would be annihilated. If the gas had been annihilated, then the momentum would also have been annihilated as well as the pressure. His way of looking at the question was that the pressure set up in the Pitot tube could never possibly be greater than the pressure corresponding to the pressure head. As to the varying composition of producer gas, his own experience was that in point of density it did not vary in practice. Although there were few speakers, the subject being of a highly technical character, the discussion ran to a fairly considerable length.

THE RADIO-ACTIVITY OF THORIUM.

Further Photographic Experiments.

The influential position which thorium has attained in gas lighting renders of considerable interest to the gas man all information concerning its physical properties. Recently attention was drawn in the "JOURNAL" to a little photographic experiment, which was suggested by the "Science Notes" of the "Daily Telegraph," proving the radio-activity of this substance. Supplementary information is found in an article by Dr. Samuel G. Tracy, B.Sc., of New York, which the "Scientific American" has re-published from the columns of the "Medical Record." There are four known elements which are radio-active—viz., radium, thorium, polonium, and actinium; and Dr. Tracy has been applying himself to showing the possible value as therapeutic agents of the first two. He does not consider the latter two, as they are the least known, are extremely rare, and almost beyond the power of purchase. Radium he dealt with in various medical journals last year; and in the present article he concentrates attention on thorium. Important as are his statements as to the curative virtues of the radio-activity and emanations of thorium, this is not a suitable place for their publication; but gas men who care to learn more about the radio-activity of thorium itself will find guidance in the opening section of Dr. Tracy's article.

He says: Thorium, one of the rare metals, was discovered in 1828 by Berzelius. Until the past few years, it has been too rare and expensive to be used commercially or in medicine. It is now, however, more abundant, and is found in certain sands in North Carolina, in Brazil, and in Norway and Sweden. The most active thorium is obtained from the minerals cleveit, broggeri, monazite, in the order given. During the past ten years, it has been used as the principal chemical for the production of incandescence in the Welsbach mantle.

Since the discovery of radium by Professor and Mme. Curie, renewed interest has been excited in thorium, because it has been found, by Professor G. C. Schmidt, to possess the property of radio-activity. That thorium is radio-active, is susceptible of demonstration in two ways: First, by means of a delicate electroscope, such as is used in demonstrating electrical induction; and, second, by means of the sensitized photographic plate. With the first method, when a preparation of thorium is brought near the wire attached to the two gold leaves in the electroscope, the leaves fall together, thus indicating the presence of radio-activity. The greater the rate of the discharging power of the leaves, the greater the radio-activity.

The second test (that with the photographic plate) takes a much longer time for its accomplishment—viz., from twenty-four to forty-eight hours, if a screen made from the nitrate of thorium is used; but when hot emanations from the oxide of thorium are the excitant, a photograph may be obtained in one hour. Among the first thoriographs that I obtained was one taken by three Welsbach mantles. In a dark closet I placed a photographic plate. Upon this was laid a pair of scissors, and on top thereof, three old Welsbach mantles, rich in thorium oxide. In seventy-two hours, I obtained a good negative. In other thoriographs I have taken, I employed a screen of thorium oxide—using simply a piece of pasteboard—to which I added mucilage, and dusted on it a

thin layer of thorium. Thoriographs were taken by this method in from twenty-four to forty-eight hours.

The most penetrating Becquerel rays are those obtained from hot thorium oxide. A thoriograph (shown in the article) was obtained by taking a photographic plate, covering it with thick black paper, and placing on it keys, a glove buttoner, &c. Then this plate was exposed to the warm emanation of thorium, and the photograph was obtained in one hour.

Professor Ernest Rutherford, of M'Gill University, was among the first to investigate the properties of thorium. His researches in this field have done more, perhaps, than has been effected by anyone else toward solving some of the mysteries of this remarkable radio-active substance. In 1900, he discovered that thorium gave off an inert and highly radio-active gas, which he termed an "emanation." It diffuses through gases, liquids, and even through porous substances. Rutherford considers the emanation to be the result of successive chemical changes in the thorium. By chemical action, the thorium atom produces a substance which he calls thorium X; and by a further chemical change, this thorium X produces the emanation. The emanation expels from itself a negatively charged body, which constitutes the Becquerel rays. These rays are the same as those produced by radium, polonium, actinium, and uranium.

It has been recently proved by scientists who have experimented with thorium, that its radio-activity and emanations are antiseptic, antifermentative, and inimical to germ life. . . . . The radio-activity of thorium is many thousand times less than that of pure radium. But thorium is also many thousand times cheaper ($7 a pound); and it can be used for a longer period of time at each treatment—thus making up by the increased duration of the treatment what it lacks in potency. Rutherford states that "when thorium nitrate is changed into an oxide by heat, it temporarily loses its radio-activity. However, when it is exposed to the air, it soon begins to regain its activity. In four days, it is one-and-a-half times more active; in twelve days, two-and-a-half times; and at the end of two weeks, it reaches its maximum radio-activity, which is four times as great as was the original nitrate of thorium."

REGISTER OF PATENTS.

Removing Sulphuretted Hydrogen from Gases with Simultaneous Recovery of Sulphur.—Burschell, E., of Landau, Germany. No. 6090; March 16, 1903.

The separation of hydrogen sulphide from gases has heretofore been effected (the patentee remarks) almost exclusively by a dry process, consisting in passing the gas through hydrated iron ores, which combine with the hydrogen sulphide to form sulphide of iron. After exhaustion, the ores are regenerated by being weathered or exposed to the air, whereby sulphur is set free and hydrated iron oxide reconstituted. By mixing oxygen or atmospheric air with the crude gas in the proportion required for the decomposition of the hydrogen sulphide according to the equation $H_2S + O = H_2O + S$, the reconstitution of the active hydrated iron oxide may be effected within the purifying apparatus itself. This so-called "dry method of purification" has, however, many drawbacks. Considerable space is required for the apparatus and for the regeneration of the hydroxide; and a great amount of labour is entailed for the transport of the materials. The purifying agent also often gives rise to increase of pressure, which leads to interruptions of working; and the hydraulic seals of the purifying apparatus are at times a troublesome part of the apparatus. For these reasons, attempts have already been made to eliminate the hydrogen sulphide by washing the gas with liquids, for which purpose the liquor produced in gas-works has been used. Hills caustified the liquor by heating it, and Claus produced gaseous ammonia from it, which, when mixed with the gas, combined with the hydrogen sulphide and was separated in the form of a solution of ammonium sulphide by washing with water. These methods, however, did not have any considerable success.

The process forming the subject of the present application consists, it is pointed out, essentially in oxidizing the hydrogen sulphide by washing the gas (after it has been freed from ammonia) with a solution of metallic salts, from which sulphur is separated as in the dry method of purification by means of air or oxygen.

The reaction $Fe_2(SO_4)_3 + H_2S = 2(Fe SO_4) + H_2SO_4 + S$ is known; but it is not suitable for eliminating hydrogen sulphide from gases, because it is possible to oxidize hydrogen sulphide by washing with solutions of ferric salts only when the velocity of the gas is extremely minute. Moreover, the acid set free has an obstructive effect upon the reaction.

The patentee claims to have discovered that the oxidation of hydrogen sulphide by means of ferric salts, as expressed in the above equation, can be effected in a rapid and certain manner if there be admixed with the ferric salts, salts of such metals as have a greater affinity for hydrogen sulphide and of which the sulphur compounds are capable of being decomposed by ferric salts. Copper, he says, has been found to be the metal of which the salts are the most suitable in practice for this purpose. In this process, the reaction may be represented by the following equation:—

$$CuSO_4 + H_2S = CuS + H_2SO_4$$
$$CuS + Fe_2Cl_6 = CuCl_2 + 2\,FeCl_2 + S.$$

By the reduction of the cupric salts by the ferrous salts, more hydrogen sulphide can be oxidized. The proportion in which the ferric and cupric salts must be employed depends entirely on the amount of hydrogen sulphide contained in the gas. Under ordinary conditions, for every 95 parts of ferric chloride solution, containing 30 parts of Fe_2Cl_6 in 100 parts, 5 parts of sulphate of copper solution (30 per cent.) are required. If the amount of hydrogen sulphide in the gas is high, more copper salts must be used—to 70 parts 30 per cent. ferric chloride solution, 30 parts 30 per cent. sulphate of copper solution. To find the exact proportion, the hydrogen sulphide must be determined in each case. The increase of the copper salt employed decreases the power of purifying the gas. Therefore, it is remarked, the amount of copper salts should be limited as far as possible.

The reaction between copper sulphide and iron salts is already well known *per se*; but its use in the purification of gas is said to be new. The method is preferably carried out either by causing the gas to pass through an apparatus in which the solution of metallic salts is trickling down in drops, or by passing the gas through rotating washers containing the solution of metallic salts. The resulting solutions of proto-salts may be employed over again after complete or partial reoxidation. The sulphur set free may be utilized as a bye-product. The oxidation may be carried out in an intermittent or in a continuous manner.

The scope of the present invention will not be effected by the additions of other salts which promote the conversion or oxidation of the hydrogen sulphide or the re-oxidation of the resulting proto-salts, or which only effect the dilution of the solution employed in the reaction.

It has already been proposed to employ iron salts or copper salts for the separation of hydrogen sulphide from illuminating gas. But these two salts, it is asserted, have never yet been employed conjointly for the purification of illuminating gas and the recovery of sulphur in such a manner as to allow of the reaction taking place as stated. This last reaction was the less able to take place with the methods of purifying by means of metallic salts as employed hitherto, for the additional reason that the gases were always allowed to pass into the solutions of metallic salts before the gases had been free from ammonia, so that hydrated metallic oxides were formed from the outset, for which reason alone the above reaction was rendered impossible. It is therefore to be noted that the preliminary freeing of the gas from ammonia is indispensable.

Gas-Engines.—M'Mullen, J. A., of Hornchurch, and Willans and Robinson, Limited, of Rugby. No. 6646; March 21, 1903.

This invention relates to gas-engines working on the four-stroke cycle, and particularly to methods of flushing the cylinders with air for scavenging purposes.

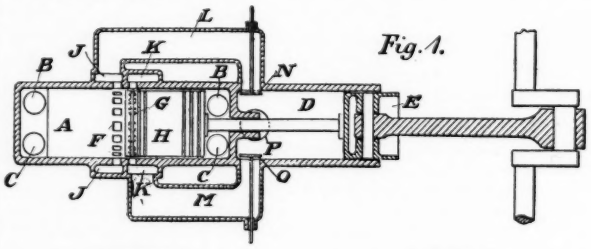


Fig. 1.

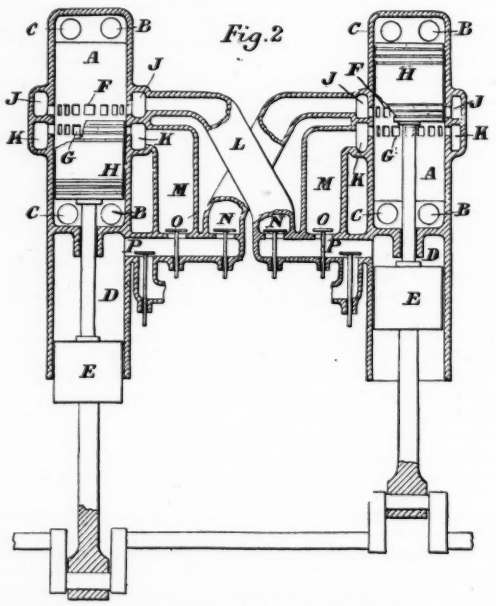


Fig. 2

The engine is made (as shown) with a double-acting cylinder A, having admission and exhaust valves at both the back and front end; B being the admission valve and C the exhaust valve. Instead of the ordinary crosshead and guide carrying the pin of the small end of the connecting rod, the guide is constructed as a cylinder D, and the crosshead as a single-acting piston E; the arrangement so formed being used as an air-pump. The back end of the pump cylinder is formed by the front end of the working cylinder, or there may be a separate diaphragm with a stuffing-box for the piston-rod to pass through.

The cylinder A is constructed with two rings of ports F and G about its centre; the rings being parallel and near together, but not connecting—there being a certain space between them. The length of the piston H is equal to, or greater than, the length of the stroke; and it is so arranged that, as the piston moves backwards and forwards, it

uncovers the front ring of ports G to the front end of the cylinder as the crank is passing the back dead-centre, and opens the back ring of ports F to the back end of the cylinder as the crank is passing the forward dead-centre—that is to say, the front end of the piston reaches the space between the rings of ports at the back dead-centre, and the back end of the piston reaches the space between the rings of ports at the forward dead-centre.

Each ring of ports has an annular belt J K, connected by an air-passage L M, through a valve N O, to the air-pump. Each valve is mechanically operated once every two revolutions; so that the pump discharges its air alternately during one revolution into the passage leading to one ring of ports and during the next revolution into the other passage. The passages act as reservoirs in which the air is brought to a pressure of a few pounds to the square inch. On the forward stroke of every revolution—*i. e.*, towards the crank-shaft—the air-pump draws in a fresh supply of air through a suitable valve P.

The action of the engine shown in fig. 1 is as follows: The air is brought to its maximum pressure alternately in each air-passage L M at the end of the backward strokes; and it is arranged that the air-passage M to the front ring of ports is being charged with air during the backward stroke, which forms the working explosion stroke of the front end of the cylinder. As the piston approaches the end of this stroke, the forward exhaust valve C is opened, and the pressure in the cylinder falls. Then the piston, continuing its motion backwards, uncovers the front ring of ports G. Air rushes in and flushes out the cylinder as the crank is passing the back dead-centre Thus, in the case of the front end of the cylinder, the air-pump puts up the air pressure just at the moment it is required.

It will be seen, however, that the explosion in the back end of the cylinder cannot be arranged at equal intervals with the explosions in the front end, whereas the pump strokes work at equal intervals. It is arranged that the alternate strokes of the pump which supply air for the back end should occur during the compression stroke in the back end of the cylinder. The air reaches its maximum pressure in the passage L to the back ring of ports F at or about the moment of explosion in the back end of the cylinder. At this moment, the valve N between the air passage and the pump closes, and the air is retained under pressure for about half-a-revolution until it is required, when the back ring of ports is uncovered by the piston at the end of the explosion stroke in the back end of the cylinder.

In some cases (as fig. 2), when two double-acting working cylinders are used, each with a single-acting cylinder and piston in front to act in the dual capacity of crosshead guide and air-pump, the cranks are placed at 180° apart; and it is arranged that the explosions in the front end of one cylinder occur alternately at equal intervals with the explosions in the back end of the other cylinder, and *vice versâ*. The air-pumps of one line are arranged to supply air for the front end of its own cylinder, and for the back end of the other cylinder. The air-pump of the second line supplies the air for the front end of its own cylinder and for the back end of the first cylinder; the passages being cross connected for the purpose. In this case, the air is brought to its highest pressure by the pumps always at the time when the pressure is wanted; hence there is no stored air to be kept under pressure for any length of time. There is also no need, as there is in the case of one double-acting cylinder, to make the clearance space of the air-pump as small as possible. In the case of the two double-acting cylinders arranged as described, the clearance space of the pump simply acts as additional capacity to the air-passages. A large clearance space in the pump is desirable in the case where the stuffing-box of the front end of the working cylinder is placed in the pump clearance.

When two double-acting cylinders are cross connected as shown, it is not essential that there should be any valves N O between the pump and the passages to the rings of ports. All that is necessary is an air admission valve P, for letting fresh air into the pump on each forward stroke. At the end of the backward stroke the pump will open at the same time to the front ring of ports in its own cylinder, and to the back ring of ports in the other cylinder. The one that needs flushing will at the moment have its exhaust-valve open, and so will offer a free passage to the air blast. In the other cylinder, the admission valve will have just closed; and all that will happen is that the charge will obtain a small additional supply of air.

Mixing Air and Gas for Illuminating Purposes.—Lake, H. H.; a communication from the "Selas" Company, of Berlin. No. 6732; March 23, 1903.

This patent refers to the apparatus described by Mr. F. D. Marshall in his paper read before the Institution of Gas Engineers last June—see "JOURNAL," Vol. LXXXII., p. 790.

In the specification relating to the invention, filed in December, the patentees remark: In illuminating installations in which the increased gas pressure is obtained by means of a motor in constant operation, it is usual to regulate the pressure by the arrangement of a circulation conduit; but nitherto such circulation conduits have been employed solely in installations in which one kind of gas only has been placed under high pressure. In accordance with this invention, uninterrupted operation is provided for by means of circulation conduits in appliances for mixing gas and air, and also for the supply of the mixture at a high pressure; so that in this case both air and gas (or two different kinds of gas) are sucked in and forced out. The suction of the two kinds of gases may be effected either into a common chamber or into separate chambers. The employment of a special circulation pipe for gas and another for air is not possible, because exact co-operation of the valves leading back to the pressure main is unattainable.

In order that both kinds of gas may retain the mixing proportions originally decided upon, it is essential, according to the patentees, that the same excess pressure valve should cause the obturation of the gas-supply pipe, and also, at the same time, that of the air-supply pipe, by the transmission of the pressure, while at the same time communication is established between the suction chamber and the forcing chamber, or with the service-main. When this is the case, the suction and forcing of air and gas no longer takes place, but the suction and forcing of a mixture of gas and air from the pressure chambers through the common valve into the circulation pipe. Provision must, however, not only be made for the simultaneous obturation of the supply valves for the gas and air, but also that, under normal conditions, when the circulation pipe is inoperative, the gas shall not be able to pass to the air-conduit. This may be effected by the arrangement of special non-return valves between the gas-conduit and the air-conduit, or by the special manner of placing the suction valves for gas and air in the circulation conduit so that they co-operate.

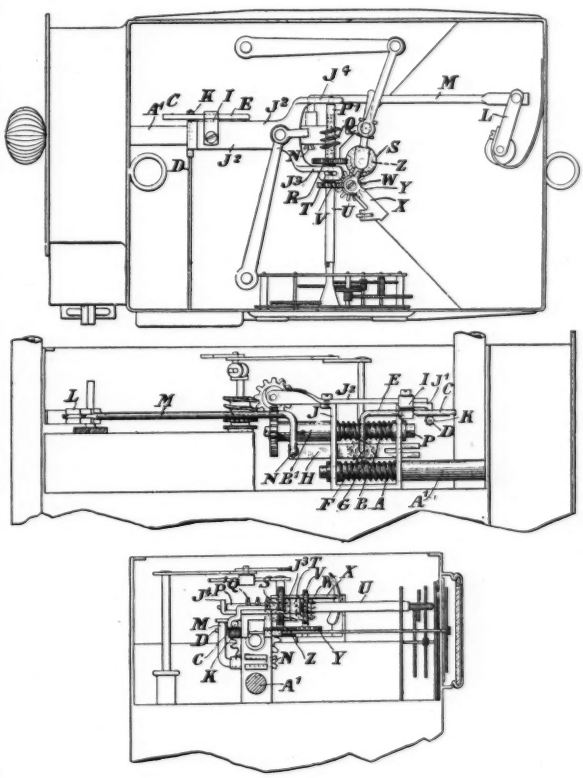
After the obturation of the gas-conduit and of the air-conduit has been effected, it is possible (as shown by various constructional forms of apparatus illustrated in the patent specification) for the suction of the gas and air mixture into the forcing chamber of the suction and forcing device to take place either through the gas-supply valve or through the air-supply valve, or through both. This latter is said to be advantageous, because an increase of resistance in the suction and forcing apparatus is obviated, which would otherwise take place if, after the circulation pipe were rendered operative, the whole of the gas and air mixture to be supplied had to pass through one only of the suction valves.

A further improvement consists in the fact that the air-suction valve also serves as a non-return valve. In this case, the special valve, which would otherwise be necessary for obturating the air-supply pipe, is not required.

The resistance during the suction of the gas and air mixture may also be still further diminished owing to the fact that the circulation conduit is directly connected with the operative chamber of the suction and forcing apparatus. In this case, there is arranged in front of the obturating members which cut off the admission of gas and air a special non-return valve, which normally works idle, but which, when the circulation pipe is operative, is maintained closed by the excess pressure, and thereby cuts off the supply of gas and air.

Coin-Freed Mechanism of Gas-Meters.—Glover, R. T., of Queen Victoria Street, E.C. No. 7796; April 3, 1903.

This invention relates to the class of coin-freed mechanism described in patents No. 22,830 of 1894 and No. 20,014 of 1901; the object being to make the unconsumed-gas indicator more positive in action, and also the method of securing the spindle of the index mechanism and the spindle operating the closing worm



The drive and closing worms A B are placed one above the other; and instead of securing the rack C operating the unconsumed-gas indicator spindle D upon the link, the rack is formed upon a lever E, which is pivoted on the axle, or forms part of the axle F of the pinion G in the link H, and the lever E (which has a spring action) is placed under a projection I of the frame J carrying the worms A B, so that it is always positively in contact with the teeth of the pinion K on the indicator spindle D, and the link H is connected to valve-operating lever L by a rod M pivoted to the link H and provided at that part with a split end N, so that, after passing through the link H, the split portion can open out, or be opened out, to retain the rod in position—the other end being secured to the valve-rod L by a pin, or the rod may run direct from the valve-operating spindle crank to the gas-indicator spindle, a branch piece connecting the link for movement.

The frame J, carrying the worms A B and link H, is made in one piece, and has a turned-down end J^1 for carrying one end of the unconsumed gas-indicator spindle D.

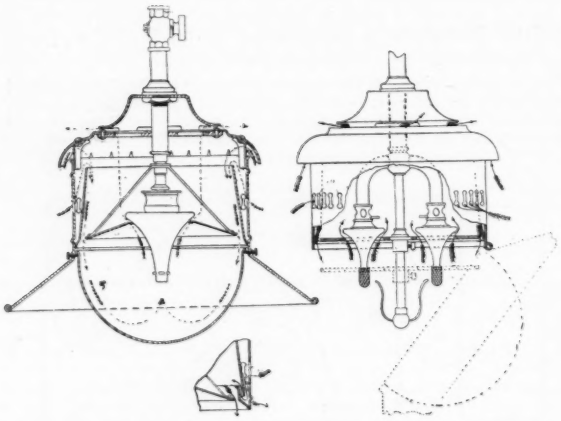
The worms A B are the same size as the rods A^1 B^1; and one end of each rod is reduced and fits a reduced hole in the frame J—a washer P on the outer side securing each rod to the frame J.

The frame J has secured to it a plate J^2, having two extending arms J^3 J^4 carrying the spindle P^1 having the worm Q and a pinion R connecting the worm S of the meter mechanism (as described in the 1901 patent referred to above) for operating the closing worm B; and a further curled or bent back portion T of one of the arms J^3 carries the end of the spindle U having the gear wheel V, which operates through the spindle the meter index mechanism—the motion being conveyed from the worm W on a branch piece X, the spindle of the worm carrying a pinion Y which meshes with a pinion Z on the bellows-operating spindle.

Inverted Incandescent Gas-Lamps.—Smith, T. B., of Handsworth. No. 10,191. May 5, 1903.

This invention, relating to inverted incandescent gas-lamps, is designed to admit of the parts of the burner being used within an inverted glass shade without the usual air inlets at the bottom or crown of the shade, and by which "a perfect shadeless down light is produced."

Just below the upper part of the china cone of the burner it will be seen that a deflecting plate is suspended, having a central opening usually about the same diameter as the base of the cone; so that the heated air from the burner may readily escape through the opening thus formed between the deflecting plate and the cone. At a suitable distance above the burner, a hood is formed having openings near the centre; and upon the interior of the hood a further chamber is formed, having side outlets, preferably of narrow horizontal slot shape, and which lie near to the hood. Hence the hot air, after passing from the cone, further flows through the hood into the upper chamber, and escapes to the atmosphere by the side slots.

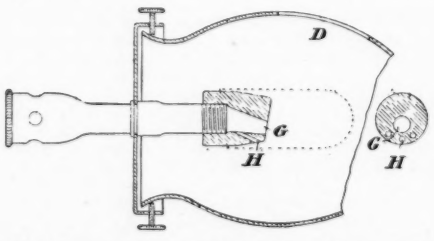


Between the deflecting plate and the hood is fixed the body of the lamp, cylindrical in form and provided with means for attachment to the hood, but leaving an annular inlet space at the top between it and the hood. The body extends to a short distance below the deflecting plate, and has an annular space between the plate and the body. Within this body a "basher" is placed, connected at the lower edge to the body, so as to be closed while its upper edge is open—that is, leaving an annular space around it and the body. Around the body are perforations, so that the air passing in through the perforations strikes against the basher and has to pass upward and over it, so as to break its force. To the lower part of the body is secured the inverted glass shade, without any air inlet thereat; also about the bottom of the body the usual extended reflector is secured.

The air supply for the burner passes through the perforations in the body and over the basher, and also beneath the hood and over the body and basher. It then falls downwards round the deflecting plate to the bottom of the glass shade and rises centrally to the burner. When heated, it passes up the cone and escapes between it and the deflecting plate, and again through the upper part of the hood, &c.; thus forming an independent outer ring of fresh air to the burner, and a central outlet for the hot air.

Incandescent Burner for Lamps Suspended in an Inclined or Horizontal Position.—Arendt, O., of Berlin. No. 26,433; Dec. 3, 1903.

In the case of inclined or horizontally suspended incandescent gas-lamps, the patentee points out that the mantles are not uniformly heated and lighted, because the flame which is emitted from the mixing-



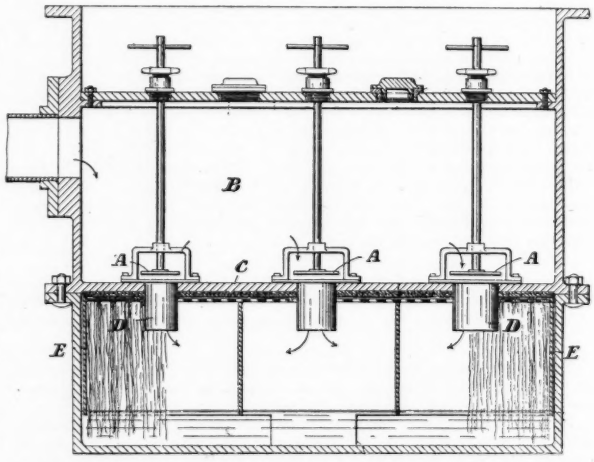
tube acts with greater intensity upon the upper than upon the lower section of the mantle. Besides the inconvenience of a worse illuminating effect, this circumstance causes the mantle to soon lose its shape and to undergo very early destruction on account of its being not heated uniformly. To avoid this, he proposes to arrange for the escape opening for the mixture of gas and air being bevelled off, or being arranged under a suitable angle—there being also provided inclined auxiliary orifices in the burner-head, if desired. In this way, "the burner flame is compelled to touch the lower part of the incandescent mantle first; thus insuring uniform heating and lighting."

The mixing-tube (as shown) is horizontally directed, but, of course, can be suspended in an upwardly or downwardly inclined direction. The glass C has at its upper section an outlet D for the rising hot combustion gases. The burner-head to which the incandescent body is fixed is provided with an escape opening G for the mixture of gas and air, which is downwardly directed in an inclined direction and merely bevelled off towards its mouth. Out of this main opening G there are provided in the lower part of the burner head any number of downwardly inclined auxiliary orifices H. The burner-head is bevelled off at an angle governed by the angle of suspension of the lamp.

Enriching Coal Gas.—The Gas Economizing and Improved Light Syndicate, Limited, of Leadenhall Street, E.C., and J. M'Coll, of Barking, Essex. No. 622; Jan. 9, 1904.

The invention has reference more particularly to apparatus of the kind wherein the carburetting or enriching chamber contains a large number of wicks, cottons, or the like, from which the vapour of the enriching liquid is absorbed by the gas as it flows between or over them—the enriching chamber being arranged beneath the tank or chamber containing the enriching medium, and being kept supplied with liquid from the latter chamber by a bird-fountain arrangement and by suitable valves; while the inlet of the gas takes place through a special receiving chamber having valves intended to regulate the distribution of the gas into the compartments of the enriching chamber according to the degree of carburation or enrichment required.

The apparatus, as regards its main construction, was described in patent No. 14,031 of 1889, in conjunction with patents No. 18,082 of 1891 and No. 14,111 of 1886. But the present invention has reference to various detail improvements designed to simplify the construction in certain respects, and also to render the action more complete and the working more reliable and certain, by substituting for the valve arrangement in the inlet chamber a special arrangement of hand-operated valves instead of the automatic valves previously used; and means are provided whereby the interior of the chamber can be inspected so as to ascertain the condition of the valves without taking it to pieces. It has been found (the patentees say) that in some cases naphthalene gets deposited on the inlet valves, and that this may be prevented by a preliminary introduction of enriching fluid into the gas before it reaches the valves. In addition, improved means are employed for carrying the wicks, whereby it is possible to have the carburetting chamber practically full of fluid; and the whole of the wicks, and the parts holding or supporting them, form a self-contained "basket," which can be put in or taken out altogether. In conjunction with this, there is an improved construction of distributing trough or tray for carrying and feeding the wicks; the purpose being to effect a more even distribution of the carburetting fluid to the wicks. Suitable baffle plates, moreover, are provided among the wicks for bringing the gas more thoroughly into contact with them as it passes through the enriching chamber.



The apparatus (as shown) comprises, as before, a suitable outer casing provided with flanges, whereby its parts can be bolted together. The gas supply-pipe is on the left; and there is a horizontal partition dividing the lower or carburetting chamber from the three upper compartments. These latter comprise, as previously, the gas inlet or receiving chamber, next to which is the fluid chamber or reservoir, and next to this again is the outflow passage or chamber whence the enriched gas finally reaches the service-pipe system—suitable partitions or vertical walls separating the three chambers. These and the other parts shown correspond to the similar parts in patent No. 14,031 of 1889, by reference to which the general construction will be understood.

The improved inlet arrangement, constituting the first feature of the present invention, comprises three valves A, whose spindles work through stuffing-boxes in the cover of the chamber B—this cover being a rigid plate, instead of a flexible diaphragm as before. The lower ends of the spindles pass through guide-holes formed in bridge-pieces or brackets secured on the bottom or horizontal partition C. The stuffing-boxes have screw glands provided with lugs or finger-pieces whereby they can be turned when necessary, and the valve spindles

have cross-handles for operating them. Beneath the valves, and controlled by them, are situated short flanged tubes or nipples D, secured in the partition C, and forming three tubular passages which are successively of larger and larger diameter—the respective valves being made of corresponding size. The arrangement is such that the valve-spindles can be moved up and down readily by hand, to open and close wholly or partially any of the valves according to the manner in which the action is proceeding; the valves remaining in the position to which they may be set, by reason of the grip or friction of the packing in the stuffing-boxes.

The improved means for carrying the wicks comprises a rectangular sheet-iron frame, casing, or "basket" E, open top and bottom, which is arranged to fit inside the carburetting chamber. The frame carries the whole of the wicks, which form a mass or packing practically filling it. The basket is divided longitudinally into three compartments by means of partitions; and in each compartment is arranged a series of transverse baffle-plates. At the upper part of the basket is fitted the distributing tray or channel-frame, for giving a supply of oil in a downward direction over the wicks in addition to the supply they take up from the bottom of the chamber by capillary action. The tray is formed of channelled arms as in the former patent; and the controlling of the action is effected as indicated therein. In the present case, however, the arms are provided with short transverse branches, from which the wicks are suspended in transverse rows in any suitable way, while between the rows are arranged the baffle-plates. Above the tray and over the whole basket is laid a perforated sheet metal wick plate through which a further large quantity of wicks are threaded, so as to practically fill up all the spaces not occupied by the frame wicks.

In hot weather (when the fluid is volatilizing freely), it may be sufficient only to open one of the valves—say, the left-hand or smallest of the three; whereas in colder weather, two or more of the valves would be open The advantage of this is that it permits of regulating the flow of gas, since various combinations of different sized apertures can be brought about. The effect with one valve open is that the gas flows only through one of the compartments of the chamber at a somewhat rapid rate; whereas with two or more valves open, it passes through two or three compartments, but, of course, more slowly, and therefore, with the same consumption, it is in contact with more of the wicks for a proportionately longer time. The gas in flowing along the compartments of the enriching chamber is forced to pass from side to side, as indicated by the arrows, between the baffle-plates, and hence it is brought into very intimate contact with the wicks, which, in this case, are in transverse rows instead of in longitudinal rows as in the former arrangements.

Generation of Gas.—Brooks, W. H., of Adelaide, South Australia. No. 2481; Feb. 1, 1904.

This invention relates to plant for the generation of gas (more particularly from wood) for illuminating, heating, and power purposes; the object being to provide plant which "well adapts itself for private installations and for the use of householders in outlying parts for the generation of gas free from tar and other impurities—being thereby suitable for power purposes, while at the same time the gas may be used for heating and illumination with incandescent burners, or, after enrichment, in ordinary open burners."

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7338.—Worringen, E., Schulte, C., and Padberg, E., "Device for automatically distributing gas to burners." March 28.
7347.—Thwaite, B. H., "Generating gas." March 28.
7374.—Hunt, C. W., "Handling coke." March 28.
7375.—Fellberg, L., and Boellert, H., "Burners." March 28.
7408.—Mellor, P. H., "Gas or oil engines." March 29.
7425.—Anderson, B., "Incandescent burners." March 29.
7426.—Izzett, J., "Regenerative furnaces." March 29.
7484.—Anderson, J., and Mackay, J., "Wet meters." March 29.
7485.—Scott-Snell, E., and the Scott-Snell Self-Intensifying Gas Company, Ltd., "Incandescent burners and lamps." March 29.
7488.—Rosenberg, A., "Generation of acetylene." March 29.
7557.—Pike, J. P., "Gas-stoves." March 30.
7592.—Radcliffe, J., "Manufacture of gas." March 30.
7598.—Arshauloff, V., "Exhausting or compressing gas." March 30.
7627.—Sanders, E. W., "Gas pendants." March 31.
7656.—Pountney, W. J., "Gas-engines." A communication from S. Dobelli. March 31.
7668.—Wien, H., and Miniz, R., "Mantles." March 31.
7705.—De Brouwer, J., and Jenkins, W. J., "Quenching and carrying coke." March 31.
7722.—Onslow, A. W., "Reducing valves for high-pressure gas." March 31.
7726.—Duckham, A. M'D., "Incandescent lighting." March 31.
7733-4-5.—The Vereinigte Maschinenfabrik Augsburg und Maschinenbaugesellschaft Nürnberg A. G., "Explosion engines." March 31.
7740-1.—Thier, M., "Combustion motors." March 31.
7767.—Hamilton, J. H., "Gas-producers." April 2.
7771.—Graham, M., "Charging of coke-ovens." April 2.
7793.—Phillips, E., "Enriching hydrocarbons" April 2.
7804.—Wright, H. W., and Darwin, H., "Griller." April 2.

Tunbridge Wells Electric Lighting.—The Tunbridge Wells Town Council have received an offer of £80,000 from a private London Company for their electric light works, which is £10,000 more than the cost up to date. Opinion in the Council is divided on the subject; those who unsuccessfully opposed the sale of the borough telephones advocating the retention and development of the electric light under municipal control. After a prolonged discussion, the decision was postponed till the June meeting.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Decimal System.

Sir,—Since none of the distinguished members of the gas industry will take up the cudgels on behalf of a decimal system which their experience as constructive engineers and mathematicians must have shown them to be infinitely handier in all calculations than our present combination of duodecimals and decimals, may an employee, after long hesitation, beg your attention to a few considerations solely from the user's point of view? An assiduous reader of the "Journal," I have seen with great regret its hostility to a system which has been adopted by the greater part of the civilized world, where it has displaced the old systems, very similar to our own existing one, and all, like it, founded on the originally simple calculations and natural contrivances for measuring at hand to the uncultured man.

It would be out of place to repeat the many arguments in favour of the metric system, or any other decimal system connecting all measures by a single unit of length. All are clearly expounded by the Decimal Association. Nor can we here consider whether our own coinage should be changed at the present time; whether we should keep our unit and subdivide it differently, or rather try to fall in line with the United States—making our double-florin or new crown, equal their dollar, and thus conform to the monetary unit general in part of the Far East, and also approaching the Latin nations' *écu*.

The constructive work in our industry follows the rules of all engineering, and need not be debated here specially. Where we and water companies are alone, is in our way of distributing and charging for our goods by measure. We all know that the "hundreds" of cubic feet are never, except at 2s. 6d. per 1000 cubic feet—I naturally exclude such obsolete prices as 3s. 4d. and 4s. 2d.—represented by an exact penny. We charge the consumers the nearest integral penny, and by an infinity of *plus* and *minus* errors compensate ourselves and them. Though not accurate, it is the best and only practical way. It is the same with prepayment consumers. Taking the usual extra charge of 1od. per 1000 cubic feet, it is only at the price of 3s. 4d. (all included) that we give an exact number of cubic feet for a penny. At all others, we can only approximate closely. For gas at 2s. 4d. per 1000 cubic feet, or 2s. 7d. and so on, would it not be as simple to say and to calculate that the cubic metre (35·315 cubic feet) costs 1d. or 1·1d., &c., as the case may be? The reduction for the ready-reckoning table by which all gas bills are made out, would be very simple, and as accurate as now. Then, too, for a penny, a prepayment consumer—paying, as it were, 2s. 4d. *plus* 1od. per 1000 cubic feet—that is to say, about 1·3d. per cubic metre—would have nearly 730 litres for 1d., and so on. Of course, these reductions do not work out exactly under the present conditions; but anyone will, I think, be able to see how easily all could be adjusted.

I venture to affirm, for what such an opinion may be worth, that in our particular case the expense of changing the gas-meter indices would be more than compensated for by the consumer's greater facility in reading his meter, by his clearer conception of what he is receiving, using, and paying for, and by our own greater speed in making out and checking the bills. The statement of consumption by a burner or stove is more readily grasped when given in litres than in cubic feet and fractions. The sale and registration of residuals, and the measurements and percentages in the internal economy of a gas-works, are made so much clearer and more logical that no argument is required in favour of the change. An average man becomes familiar with the system and appreciates it in a fortnight, by which time he has seen how his accounts are simplified.

It is in our practical way—for having compared our people with foreigners many times, I am convinced it is not an idle boast to say we are more practical—that the question should be settled. Could you not invite the opinion of the many distinguished gas engineers who have real knowledge and experience of both the English and Continental methods? Could not some company take one of its districts with 2000 or 3000 consumers, change the meter-indices, and make up the accounts in cubic metres at 1·1d. per cubic metre for a few quarters, publishing its experience at the proper time? Surely the experiment could not cost much. Will not the members of the gas industry approach the question with an open mind—first reading the pamphlets which the Decimal Association will send to anyone, and afterwards applying the system to their own case? I assure you the little exercise would be a fascinating one, and if fairly and thoroughly tried, could only lead to the conviction that the metric system is a great advantage to the person who uses it. The simplicity, the connection between the various units of measurement, so that a metre rule, a slide rule, and a table of specific gravities will suffice for getting out any quantities, cannot but ensure the support of all practical men. I do not for a moment think the change in all our other industries is really the enormity it may appear at first sight; but this is for the people interested to discuss.

I must not waste your space, and have therefore kept strictly to the considerations contained in the "Journal's" last article on the subject. It is useless to continue Byzantine discussions on the theory of one and the other system. It is a waste of time to say that a duodecimal scale of notation is the proper solution; mankind will never leave the decimal scale. It does not matter that the metre is not any exact millionth of a meridian; that was an example of the unpractical, theoretical precision dear to the Latin mind and derided by the Anglo-Saxon. Let us try the system in its actual bearing on our industry, as others will do in theirs, and as the Continentals have done already. I may be regarded by many people as a mistaken enthusiast—the world is full of them; but I do not think my request for a trial is altogether unreasonable.

March 31, 1904. One Who has Tried Both.

"Jager" v. "Standard" Purifier-Grids.

SIR,—Messrs. S. Cutler and Sons seem to be somewhat perturbed in their minds concerning my article entitled "A New Departure in Purifying Grids." Why so, I cannot tell; inasmuch as due prominence and eulogy were given to the invention with which they are associated.

The paper itself was a *résumé* of one read before a meeting of German Gas Engineers, and was purely technical—in which the evolutions in grids due to experiments made by different engineers were traced. The illustrations and diagrams were made from experimental apparatus submitted to the meeting; so that when Messrs. Cutler and Sons describe the experiments and illustrations as "delusive," I am inclined to think they are going a little beyond the mark.

The experiments, and the apparatus employed, were so simple that anyone can easily repeat and verify the conclusions. At the time the paper was read, the box employed actually represented a section of arrangements of "Jäger" grids. If since then the "Jäger" staves have been rearranged in actual practice, I am not cognizant of the fact.

Messrs. Cutler and Sons' remarks appear to convey the impression that, in their opinion, the oxide—for the sake of demonstration and proving a case—was "indulged" with just sufficient moisture to cause it to form the arches in question; in other words, that the oxide was "doped!" It is altogether an unworthy insinuation; and I pass it by with the remark that the experiments were made with oxide or lime with the moisture (perhaps 3 to 5 per cent.) as would be employed in practice. Messrs. Cutler and Sons must surely know that absolutely dry oxide or lime would not work.

The main difference between the "Jäger" and "Standard" systems lies in the fact that, in the former, the gas must pass through the purifying material laterally, and to effect this the purifiers must be fitted with "curtains" or louvres, which are expensive, and cause considerable disturbance to the existing order of things; whereas the "Standard" arrangement permits the gas to flow in a vertical direction, and further permits the division of the gas into *two streams*, which considerably increases the efficacy of the arrangement. For this reason, the illustration, in the advertisement, shows a row of ordinary grids in the centre of the purifier. Were the two streams not desired, this row of ordinary grids could be dispensed with, and the purifier filled right up solidly. At the bottom there must always be a row of ordinary grids to provide a gas-way underneath, and to prevent the oxide from resting actually on the bottom of the purifier.

It has been frequently put to me that, in certain cases with purifiers of great area, it is the practice to use only two layers of oxide (say) 2 feet deep; and no inconvenience ensues. In such a case, where would be this benefit of inserting the "Standard" grids? The reply is that by preventing this mass consolidating—as it surely would do quickly in the ordinary way—the life of the purifier would be greatly lengthened. Furthermore, if with the existing arrangements no inconvenience is felt in using layers 2 feet thick, they could be increased to 4 feet thick with impunity if the "anti-consolidators" were inserted.

At the time Messrs. Cutler and Sons approached me, and made very strenuous efforts to acquire my English patent, they did not appear to suffer qualms of conscience on account of the invention being of semi-German origin; and they were quite content with the invention as it stood—whether it was termed "Bamag" or "Standard." Altogether, I fail to see that their remarks concerning the nomenclature of the grid have anything to do with the case. But, after all, "What's in a name?"—a grid by any other name would smell as sweet!

Queen Anne's Mansions, S.W., April 11, 1904. F. D. MARSHALL.

Charging Three Retorts Simultaneously.

SIR,—Referring to the description of triple charging and drawing machines at the Toronto Gas-Works, given in your issue of March 29, I may say you are quite correct in stating that Bronder's machines have got beyond the drawing and specification stage. Last summer, I saw them in action in two of the New York Gas-Works, in the Point Breeze works at Philadelphia, and in the Montreal and Toronto Gas-Works in Canada.

As shown in the photographs accompanying your description, the machines have each a boiler and engine attached, which, of course, travel along with them. They are very simple in general construction, and quite easily understood when seen in action. The retorts to be operated together must, however, be placed exactly in vertical line above each other.

In the Point Breeze works, the settings—which seem to have been specially designed to suit the machines—have nine retorts, in three vertical tiers, in each oven; one ascension-pipe being, of course, common to three mouthpieces. The retorts are only about 10 feet long. In this works, I saw four men, with the machines referred to, draw and charge 20 retorts in about 20 minutes, working in a very leisurely way. There is a special arrangement at these works, by means of which any ascension-pipe, should it happen to get choked, can be cleared in a few seconds. It consists of a light pneumatic—or hydraulic (?)—ram, which travels on rails fixed to the roof of the retort-house, above the ascension-pipes.

In the Toronto Gas-Works, there are only, if I recollect aright, six retorts in the oven. The coal and coke conveyors in this works are also very ingenious. They were designed, I understand, by the same Mr. Bronder. The pans of the coke-conveyor in the retort-house run in a trough containing water; and there is a cover forming a sort of water-lute—the object being to keep the steam formed in quenching the coke as much as possible out of the retort-house.

I may mention that, through the kindness of various gas managers and others in the United States and Canada, I had opportunities in my travels last year of seeing many other contrivances in connection with gas-works which were quite new—at least, to me. In the Montreal works, for instance, I was shown a most interesting portable coal-elevator used for stacking coal in the very extensive coal-sheds which are necessary there. It is dangerous to stack the coal higher than about 10 feet, owing to the large percentage of sulphur it contains. The little elevator is driven by a small electric motor, and can easily be moved about anywhere. In the same works I noted that the ascension and bridge pipes were formed of light steel tubing screwed into connecting pieces of the required shape. This seems a good idea, as the weight and strain on the mouthpieces and hydraulic mains must be much reduced by its adoption.

Leith, April 8, 1904. A. J. WALKER.

The Southampton Appointment.

SIR,—I notice the Directors have appointed their Chief Clerk to the secretaryship, after having advertised pretty freely, with the result that there were 96 applicants for the post. These applicants no doubt have gone to some trouble in procuring the requisite testimonials, which in some cases would necessitate approaching their Directors or Committees, who probably think they are dissatisfied with their present employment or are unsettled, when perhaps it is not so, but they are simply endeavouring to better their positions when opportunity offers—which Directors having their officials' welfare at heart do not, as a rule, object to.

Probably some of the candidates, with a view to further their cause, have journeyed to Southampton, at considerable loss of time and expense to themselves; and I think when one of the Company's own staff was an intending applicant, it would have saved both trouble and money to many if this fact had been stated in the advertisement, as in nine instances out of ten the local man is in such cases appointed.

Had his testimonials been returned with the usual "With thanks," his non-success would have been taken with more grace by

April 9, 1904. ONE OF THE UNSUCCESSFUL CANDIDATES.

The Late Mr. Ovington.

SIR,—I have read Mr. Good's letter in the "JOURNAL" of the 5th inst.

Mr. Good seems vexed that I stated that he was a "retort-setter." I meant, of course, at the time I employed him to alter my furnaces; and he had no objection to that title at the time. I believe I am right in saying that I gave him the letter to the Carshalton Gas Company that procured him the appointment of Manager of the Company; and I should not have done that, had I not known that he was a good man for the appointment. I am glad to find that he has done so well in that employment.

I have only to add that all you stated about Mr. Ovington in the "JOURNAL" is, *to my knowledge*, quite correct.

This correspondence must now cease, as far as I am concerned.

April 9, 1904. MAGNUS OHREN.

Reduction in Price.—A reduction of 2d. per 1000 cubic feet in the price to ordinary consumers has been announced by the Alnwick Gas Company, to take place after the April collection. This brings the charge to 3s. 2d. per 1000 feet, less discount, or 3s. net.

Public Lighting of Consett.—At last week's meeting of the Consett Urban District Council, the Gas, Finance, and Roads Committee reported that, after carefully considering the respective offers of the Gas and Electricity Companies for the lighting of the district, they were of opinion that the terms of the former Company were most favourable. The Chairman of the Council (Mr. John Lowes) said that a deputation had waited upon the Shotley Bridge and Consett District Gas Company; and they had agreed to fix 50 extra incandescent lamps, bringing the total number in the town to 100. They would also give them 30 Welsbach intensified lamps, and would, moreover, convert 22 Bray lamps into powerful incandescent lights, thereby doubling the illuminating power and saving the ratepayers £90 a year. The Company's offer was accepted.

Cromer Gas Company.—At the recent annual meeting of the Company, the Directors reported that the net profits for the twelve months ending the 31st of December amounted to £1618, or £73 more than before. After providing for interest on the debenture stock and on temporary loans, a balance of £1064 was available for payment of dividend on the ordinary stock; and the Directors recommended one at the rate of 2½ per cent. per annum, less income-tax. This will absorb £1053. There was an increase of upwards of 5¼ per cent. in the sale of gas through prepayment meters; but this was more than neutralized by the decrease in the ordinary meter consumption—the net decrease as compared with 1902 being 5 per cent. This was accounted for by the competition of the electric light and by the number of empty houses in the district. The report was adopted.

The Comparative Cost of Gas and Electricity.—At a meeting of the Vestry of St. Paul's Church, one of the most important of the parish churches of Bristol, on Easter Monday, a desire on the part of one of the churchwardens to see the building lighted by electricity met with warm opposition. One of the sidesmen, who owns extensive business premises, warned the officers of the church to keep away from electricity altogether, and to be content with gas lighting, which, he said, had always been found satisfactory. If the church were fitted up with an installation of electric light, the cost would be five times as great as it was now; and instead of paying the comparatively modest sum of about £40 a year, they would have to pay several hundred. In his own business he had made a careful trial of both systems; and when he came to work out the results, taking candle power for candle power, he was astonished at the vast difference. Gas was far more economical than electric lighting; and he urged the officers not to make any new departure which would involve heavy expense without any corresponding advantage.

MISCELLANEOUS NEWS.

ROYAL COMMISSION ON COAL SUPPLIES.

Evidence Bearing upon the Gas Industry.

As mentioned in the "JOURNAL" last week, the second report of the Royal Commission on Coal Supplies, appointed on Dec. 28, 1901, with the minutes of further evidence taken, has lately been issued. The following gentlemen, it may be remembered, were nominated to serve upon the Commission: Lord Allerton, Sir G. J. Armytage, Bart., Sir W. T. Lewis, Bart., Sir Lindsay Wood, Bart., Mr. T. Bell, Mr. W. Brace, Mr. A. C. Briggs, Professor Harold B. Dixon, Mr. J. S. Dixon, Dr. C. Le Neve Foster, Professor Hull, Mr. C. Lapworth, Mr. J. P. Maelaig, Mr. A. Sopwith, Mr. J. J. H. Teall, and Mr. R. Young. The Commissioners held their first sitting for taking evidence on July 8, 1902, and continued at intervals till the 23rd of December (the thirteenth day of the inquiry). The evidence given to that date is contained in the first report, which has been already noticed in our columns. The proceedings were resumed on June 27, 1903; and the evidence adduced down to Oct. 20 (the thirtieth day) occupies the report recently published. We commence to-day an abstract of the portions bearing specially upon the gas industry.

Sir GEORGE LIVESEY.

The Chairman of the South Metropolitan Gas Company gave evidence on the 18th of March. He said he had been connected with the gas industry all his life, and consequently his experience had been very general. All the gas used in the country was made from coal and cannel prior to 1890, when, owing to the rise in the price of the latter material, the tendency was to reduce its consumption. About that time, petroleum spirit and carburetted water gas were introduced to take its place as a means of enrichment; and benzol had been largely employed. The use of carburetted water gas had increased very rapidly during the last ten or twelve years; and according to the latest returns then available, it constituted about 10 per cent. of the total quantity supplied. The figures did not, however, include all the gas sold in the country. By the use of this enricher, gas could be produced of any required illuminating power, by increasing or decreasing the quantity of petroleum oil used. The South Metropolitan Company had not adopted carburetted water gas because they found it cost more to make than ordinary coal gas. Taking the case of two consumers, one living in his district and the other in that of the Tottenham Gas Company, in which carburetted water gas was used, there would be no appreciable difference in the amount of the gas bills, as in each case 14-candle gas was made, and therefore the light obtained from a given quantity of gas would be about the same. Whether enriched by petroleum or not, the consumer would get the same amount for the same money, provided the prices were alike. The Board of Trade returns related only to gas companies and corporations supplying gas under statutory powers; but there were some hundreds of village gas-works, and also some private ones. If these were included in the returns, they would add something like a million tons to the total quantity of coal used for making gas. He estimated that, on the figures given in the returns, 15 million tons of coal were employed in this way annually, and that the carburetted water gas took the place of about 1½ million tons—in other words, without this gas, the quantity would have been 16½ million tons. Consequently, the tendency was for the consumption of coal not to increase in proportion to the increase in the bulk of gas made. At the same time, to make the carburetted water gas which took the 1½ million tons of coal from the market, from 250,000 to 300,000 tons of coke would be needed. As from each ton of coal half-a-ton of coke was obtained for sale, the 1½ million tons took out of the market half that quantity (750,000 tons) of coke directly, and about another 250,000 or 300,000 tons indirectly. So that there would be 1½ million tons of coal saved, but a million tons less coke for sale. The Chairman remarked that the coal used for the purpose of making good the supply of fuel, which was lacking owing to the reduction in the quantity of coke made, might be made good from other than special gas coal; and that therefore, so far as gas companies were concerned, it relieved the market and made the price more easy to them for their particular coal. Sir George acknowledged that this was so. It reduced by about 10 per cent. the demand for gas coal; and whatever effect this would have upon the price would be to the advantage of the gas companies or of gas manufacturers. It would further enhance very largely the price of the coke they had to sell, so that there might be a gain in two ways. This was one of the arguments in favour of water gas—that it enhanced the price of coke.

The witness then passed on to give some statistics relating to the consumption of coal for gas making in 1882 and 1901, and afterwards those of his own Company. He said that in 1840, when the undertaking was a small one supplying gas all over South London in competition with other Companies, the quantity of coal used in the year was 5600 tons; in 1850 it was 17 000 tons; in 1860, 32,000 tons; in 1870, 61,000 tons; and in 1880, 120,000 tons. So that in the last three decades the quantity might be said to have doubled each ten years, or an increase of about 7 per cent. per annum. He went on to say that in 1880 the Company absorbed two or three others; and he gave the aggregate figures from 1880 to 1900. In 1880, the total consumption of the South Metropolitan Company and those amalgamated was 406,000 tons; in 1890, it was 638,000 tons, or an increase of 57 per cent.; in 1900, 1,131,000 tons, or an increase of 77 per cent. He explained, however, that the larger increase in the second decade was due to the introduction of the prepayment meter system, which would account in 1900 for, he estimated, 190,000 tons of coal. If this were taken off, the increase would have been only 47 instead of 77 per cent. Asked if his was a typical company, he replied that perhaps they had had exceptional advantages, and that their increase had been greater than those of other companies partly because theirs was a more rapidly extending district. Then electricity was much less used for lighting purposes on the south than on the north of the Thames. They had beaten the electric light people; and they had also beaten mineral oil by the slot meter. They were on good terms with the consumers, who, when applied to by the electric light people, said: "We are satisfied with the Gas Company." Asked by the Chairman whether he had had any tests of the electric light and gas for street lighting, he gave Bermondsey as an instance, where the Surveyor had reported that to light 23 streets with electricity would cost at the rate of 1s. 8d. per candle power per annum, whereas it could be done with gas for 7½d. per candle, by employing incandescent mantles. Reverting to the consumption of coal, the witness gave, from "Field's Analysis," the quantity used by the three Metropolitan and ten Suburban Companies for 1881, 1891, and 1901; the figures being 2,250,000 tons, 3,452,000 tons, and 3,872,000 tons. The increase in the first ten years was at the rate of 53 per cent., and in the second ten years of 12 per cent.—the lower figure resulting from the use of water gas. Figures were also furnished in regard to fourteen Provincial Corporations. In 1883, they used 1,373,000 tons of coal; in 1891, 2,075,000 tons; and in 1901, 2,729,000 tons. The increase in the first eight years was at the rate of 51 per cent.; in the last ten years, 31½ per cent., or 40 per cent. with the water gas added. The rate of increase in the Provinces, therefore, had been maintained at a higher figure than in London in the last ten years. It was explained that the difference was, to some extent, due to the use of carburetted water gas; and electric lighting had also developed more largely in London than in the Provinces. Cheap mineral oil, introduced in the seventies, and the electric light, had been the greatest competitors gas had ever had. It had none before their introduction.

Having dealt with the checks to the consumption of gas, Sir George Livesey proceeded to speak about the means of extending its use furnished by cooking and heating appliances and motors. This extension had, he said, been going on since 1870; and he thought there was good reason for expecting it to continue. It would all depend upon whether or not gas became cheaper; and this would, of course, depend upon the price of coal. If suppliers of gas were allowed to reduce the illuminating power, which was of no importance now that the incandescent mantle had come in, they would be able to make a poorer gas and make it cheaper; and it would then be much more used for power purposes, and also for heating. Asked if he anticipated the competition predicted by some people, of a gas of very low quality for purely power and heating purposes, the witness said there was something in it, though he did not think it would affect places like London. Suggestions had many times been made to supply the Metropolis with gas produced at the coal pits; but they had always been dismissed as impracticable. The cost of sending the gas would be greater than that of bringing the coal. His opinion certainly was that the use of gas for heating purposes and gas-fires was extending; and what was wanted was knowledge as to how to adapt the existing works and plant for the production of a large quantity of poor gas—say, of eight to nine candle power, or 350 to 400 British thermal units. Mond gas was not good enough; its heating power being too low to render mantles luminous. Asked if he was in favour of the enrichment of gas, Sir George replied: "I think it is an utter mistake. Hundreds of thousands of pounds have been wasted annually by utterly useless enrichment." He added that he would enrich by means of the mantle, which was the practical way out of the difficulty. With regard to the use of gas for motive power, it was not extending very much for working dynamos for generating electricity for lighting purposes. Out of 110,000 ordinary consumers in the South Metropolitan Gas Company, there were only about 50 who had gas-engines for this purpose. The Crystal Palace District Gas Company, who had 17,000 ordinary consumers, had 19 who were using gas-engines to work dynamos; while the Commercial Gas Company, out of 25,000 ordinary consumers, had between 20 and 30. But in nearly every case where they had installed a gas-engine to work a dynamo to supply electric light, the consumption of gas had largely increased. The witness gave the following instances of this: In a private house at Forest Hill, in which, in the year before the engine was installed, the gas consumption was 212,000 cubic feet, the year after it was 229,000 cubic feet. In other cases, the figures before and after were: 105,000 cubic feet, 132,000 cubic feet; 114,000 cubic feet, 154,000 cubic feet; 223,000 cubic feet, 451,000 cubic feet (more than double); 150,000 cubic feet, 175,000 cubic feet. These were, he said, all private houses. Then there was one which was 61,000 cubic feet before they had the electric light, and 669,000 cubic feet after they had it put in. The consumer must, of course, have had a great deal more light; and therefore that was not a fair comparison. But there was the case of a provision store at Upper Norwood, where the consumption was 1,290,000 cubic feet before the gas-engine was put up for the electric light, and 1,410,000 cubic feet after. He thought, therefore, it might be taken that the installation of a gas-engine to work a dynamo to supply electric light did not reduce the consumption of gas.

After referring to the Kitson light, which, though a very splendid light, witness thought would not appreciably affect the use of gas, nor would acetylene, his attention was again directed to carburetted water gas. He said he thought there was every reason to expect that the quantity of this gas made would increase in a few years. This being his opinion, it was put to him that if the production of water gas were increased to double its present quantity, or 20 per cent. of the bulk, it would take the place of 3 million tons of coal per annum. He said this was so; but he added that it would take roughly 2 million tons of coke out of the market. These were figures which could be easily remembered—3 million tons of coal saved to 2 million tons of coke less for sale. This included the coke used in making the water gas. Summarizing the result, the Chairman put it to Sir George that the three influences which, in his opinion, tended to check the consumption of coal for gas-making were mineral oil, electric lighting, and carburetted water gas. Witness said he would add another—viz., reduced illuminating power. The South Metropolitan Gas Company were already making 10 per cent. more gas from the same coal by reason of the lower illuminating power which had been granted them. This was another way of saying that the extension of the use of incandescent mantles diminished the quantity of coal necessary for lighting purposes because

a poor gas could be made for use with them, and it gave quite as good a light as the richest. Questioned as to the calorific power of gas, witness admitted that 14-candle gas was of slightly lower heating value than 16-candle gas, and that it would be *pro tanto* less powerful in an engine—the reduction being from 640 to 600 B.T.U. He thought, however, that in the future power would be much more generally furnished by gas-engines, particularly as they could now be constructed of 4000 or 5000 horse capacity. A producer gas would be made, and this would be used direct in the engine. In his opinion, the steam-boiler was doomed; but it would be some time dying.

Professor Vivian B. Lewes, F.I.C., F.C.S.

Professor Lewes attended before the Commission on the 29th of April, and gave evidence of which the following is a summary: Owing to the introduction of the incandescent gas-mantle, the tendency of the present day is towards a reduction in the illuminating power of coal gas; and the poorer quality of gas demanded will probably be arrived at by diluting coal gas, as ordinarily made by the carbonization of gas coal, with either carburetted or blue water gas. Experiments in this direction have already gone so far as to give reliable data as to what may be expected from it in the economy of coal. Even should the present tendency towards reducing the illuminating value of gas not continue, carburetted water gas as an auxiliary to coal gas will in the future play an important part, and tend to lessen the weight of coal annually carbonized. An idea of the economy in the weight of coal used when a mixture of coal gas and carburetted water gas is distributed in place of pure coal gas, may be obtained from the working of the Gaslight and Coke Company, who use carburetted water gas as an enricher, and the South Metropolitan Gas Company, who send out coal gas only. In the year ending June 30, 1902, the latter Company carbonized 1,183,101 tons of coal, and made 11,976,041,000 cubic feet of gas, or 10,123 cubic feet per ton; while the former Company carbonized 1,829,699 tons of coal, and made 22,571,273,000 cubic feet of gas, 4,079,499,000 of which was carburetted water gas, amounting together to 12,336 cubic feet per ton of coal, against 10,106 cubic feet of gas made per ton from coal alone. From this it will be seen that the gas yield per ton was practically identical for the two Companies, but that the Gaslight and Coke Company, by making 18 per cent. of their gas from coke, steam, and oil, were able to use 403,652 tons less coal than they otherwise would have had to do to get the same volume. This does not effect any economy in cost, as the carburetted water gas costs a little more than the coal gas; but it raises the illuminating power of the gas, and saves 22 per cent. of the coal used. As about 40 lbs. of coke are used in the generator, and 15 lbs. of breeze, it is evident that the amount of saleable coke will be reduced. The limit of quantity of carburetted water gas which can be added to the coal gas is arrived at from the percentage of carbon monoxide in the mixed gas, which should not exceed 16 per cent., on account of its poisonous properties. From the recommendations of the Committee who considered the question, it seems probable that this will be about the legalized limit; and this would enable 48 per cent. of carburetted water gas to be added to the coal gas, which would make the saving in coal much more marked. Should, however, the present tendency to lower the illuminating power continue, then undoubtedly the most economical method of making low-power illuminating gas, is to pass blue water gas through the retorts during the carbonization of the coal. The blue water gas, containing 38 per cent. of carbon monoxide, against 28 per cent. in carburetted water gas, would limit the admixture to about 34 per cent. If such a process were universally adopted throughout the kingdom, the total economy in gas coal would approximately amount to about 4 million tons annually. For lighting purposes, several oil processes have been introduced which give, by means of the incandescent mantle, light at a cheaper rate than even coal gas; so that it is possible to obtain a light of 1000 candles per hour at the cost of 1d., which is nearly ¾d. per 1000 cubic feet cheaper than could be obtained from coal gas.

Questioned on the various points in his evidence, Professor Lewes said the whole tendency during the past five years had been in the direction of a reduction in illuminating power—enrichment in every form being expensive. In his opinion, a useful minimum would be 12 candles. With gas of this quality, used with a mantle, perfect combustion and illumination could be obtained. Of course, he would sell this gas at a lower rate per 1000 cubic feet than 16 candle gas. The incandescent mantle might be looked upon as a great coal saver, not only in regard to the enormously increased light to be obtained from a cubic foot of gas, but also in the general tendency to a saving of gas. By the admixture of coal gas and carburetted water gas, great economy could undoubtedly be effected in the weight of coal used for gas making. Witness passed on to refer to the processes which have been introduced for burning vaporized oil and air in atmospheric burners for raising mantles to incandescence, and spoke favourably of the Kitson light, in which, he said, the electric light has a serious competitor. He also gave evidence as to the spontaneous combustion of coal on shipboard. Answering Professor Dixon, witness gave particulars of his experiments with regard to the light furnished by mantles, and stated that the addition of 48 or 50 per cent. of carburetted water gas would not necessitate any alteration in the mantle or the burner in order to get the maximum result. As to the loss of illuminating power when gas has to travel a distance, witness said his experience was that it would lose about a candle in five miles. After some further questions by the Chairman and Professor Dixon, Mr. Bell said:

I should like to ask you one general question: Whether 50 per cent. of this water gas is added or not, the general tendency of your evidence seems to be that there would be much less consumption of coal in the manufacture of gas than hitherto?

Witness: No, I do not think so; because you have a very steady increase going on.

Apart from the increase there would be?—Yes. If you used a certain percentage of water gas, you could undoubtedly reduce the amount of coal used for carbonization.

But do you think that the extra demand for gas will render the demand upon coal quite as much in future?—Even after that economy, yes.

Would you say that it would be more than in the past; that there would be an increasing demand for the manufacture of gas?—The whole tendency at the present time is to an increase. People are using so much more coal gas now as fuel gas for stoves and things of that kind, that there is a very distinct and very steady increase going on.

The Chairman said the matter was not quite clear, but he understood Professor Lewes to express the opinion that the additional use of water gas would very largely lessen the quantity of coal necessary to make a given quantity of gas; and that therefore, apart from the increased consumption, there would be a very large reduction in the quantity of coal necessary to be used in the production of the gas, which would be the equivalent of so much saving of coal. Witness assented.

Mr. J. S. Dixon asked Professor Lewes whether, taking the gas coal resources of the country, the Commission might regard the improvements he had described as a means of saving these resources; and he replied: "You may look to these various processes for augmenting the output of coal gas as distinctly likely to cause economy in the coal used for the purpose of making that gas." Dr. Le Neve Foster pointed out that, though the witness was speaking of coal, he had to buy oil for enriching his carburetted water gas. Professor Lewes said this was undoubtedly so; and therefore there was really very little economy to the gas maker in using this gas, except that it was a convenient method of enrichment. This was why he thought blue water gas would come into use in the future. Mr. Briggs then put these questions:

Supposing you put 50 per cent. of water gas into coal gas (and there is a considerable consumption of gas for gas-engines), would that make any difference, or would the mixture of water gas do sufficiently well with coal gas for engines?

Witness: No; you would require a rather larger consumption.

But the engines designed for the use of coal gas would still work with the other?—Perfectly well.

And therefore it would be a matter of price only?—Purely a matter of price. I think I can give you the ratio. The general run of figures is as follows: For power production in engines per brake horse power, town gas, 13 to 17 cubic feet; carburetted water gas, 15 to 19 cubic feet; straight water gas—that is, blue water gas—30 cubic feet. Then, of course, with Dowson and Mond gas we get from 70 to 90 cubic feet. So that it is simply a matter of price.

This practically closed Professor Lewes's evidence.

PRIVATE BILL LEGISLATION.

The Welsh Proposals for Reform.

A fortnight ago, reference was made in our leader columns to the revival of the agitation for the reform of Private Bill Legislation, and to the introduction and second reading in the House of Commons of the Private Legislation Procedure (Wales) Bill. The information before us at the time as to the argument in favour of the measure was somewhat scant; but now we have the full statement on the subject of Mr. Herbert Lewis, M.P., and from it the following extracts are made:

Mr Lewes said that he believed nearly every member who had carefully considered the question of Private Bill Legislation held the opinion expressed by the Prime Minister, when he was Secretary for Scotland, that the present system of Private Bill Legislation by Committees of the House of Commons and House of Lords was utterly absurd, expensive, and antiquated. The Lord Advocate for Scotland, speaking on a debate on the Scotch Private Legislation Procedure Bill, had stated that even in the case of unopposed measures the present system was both cumbersome and expensive, and that it was far more favourable in its treatment of the larger opponent than of the smaller. It was generally agreed that the last Parliament acted wisely when it passed the Scotch Private Bill Procedure Act. This was by no means the first time that this question had been brought forward with specific reference to Wales; and a very strong case for reform had been made out. There appeared to be some misconception on one point. It was supposed that the claim of Wales was not strong enough to justify Parliament in giving it separate treatment. During a period of six years before the Scotch Act came into operation, the number of Private Bills applied for was as follows: Ireland, 80; Scotland, 130; and Wales, 140. Therefore Wales, as regards the number of Private Bills, stood second out of the four nationalities of the United Kingdom.

The objection most frequently taken to giving Wales some power to deal with this question was that every part of the country should have the same powers. To this principle he (Mr. Lewes) had not the least objection. It was all a question of ripeness of public opinion and of finding suitable areas. In the Welsh Bill, the provisions of the Scotch Act had been closely followed throughout. The only new feature in this Bill was the proposed substitution of a Joint Board of the Welsh County Councils for the purpose of making local inquiries. If this were adopted, it would do something to relieve members from the strain of parliamentary work.

One of the most important and most valuable features of the Bill was that it extended the Provisional Order system, which was far less expensive than the Private Bill system. It was very seldom found necessary to appeal against a Provisional Order. From 1888 to 1897, 1980 Provisional Orders were dealt with, and 75, less than 4 per cent., were appealed against. This meant a great saving of expense; the House fees for Private Bills being very heavy. In the case of an ordinary unopposed Bill, the House fees of the Lords would be about £125; those of the Commons about £85—making a total of £210. In the case of a local authority seeking to promote a Gas Bill—one of the simplest Private Bills that could be brought before Parliament—even if there was no opposition, the House fees in the Lords were about £100, and in the Commons about £80; making a total of £180. These, of course, did not include agents' charges, which came to a very much larger amount, and to them must be added the fees and expenses of local solicitors, counsel, experts, and witnesses He remembered the case of a simple Water Bill, to which there was hardly any opposition, which cost £2000, although the solicitors and engineers retained by the promoters cut down their costs to one-half. If a Bill was opposed, the House fees were very heavy. The fees of the House of Lords, for

example, if a Bill took ten days in Committee, were £142, and in the House of Commons £379—making a total of £521 for House fees alone. These are some of the fruits of a system which threw an entirely unnecessary burden upon the ratepayers of many a small town. But excessive House fees were, after all, only a very small part of the grievance. One great source of avoidable expense was the cost of bringing hosts of witnesses up to London and keeping them there. Committees only sat five days a week, and five hours a day; there was often considerable uncertainty about the time when the witnesses would be required; and they frequently had to wait for days before they were called, if they were called at all. If the inquiry were local, a large share of this expense could be saved, and, more important still, the Committee would have an opportunity of inspecting the place to which the Bill related. They would thus be able to dispense with much of the evidence that would otherwise be required, and would have better materials for arriving at a sound judgment. The Scotch Private Bill Procedure Act was passed five years ago. The testimony of all connected with its working was that it had been a great success, had caused injustice to no one, and had saved much needless trouble and expenditure.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Meeting of this Company was held on the 31st ult., under the presidency of Mr. CHARLES LAWLER, J.P.

The SECRETARY and MANAGER (Mr. Francis T. Cotton) having read the notice convening the meeting,

The CHAIRMAN moved the adoption of the report and accounts, which were noticed in the "JOURNAL" for the 29th ult. (p. 854). He said it would be seen that they had sold 762,770,000 cubic feet of gas, which was an increase of 32,562,000 cubic feet over the corresponding period. They had received for this £138,584, or a decrease of £1357, which was caused by the reduction of 3d. per 1000 cubic feet in the price. For coke they received £15,907, or a decrease of £149. A smaller quantity had been made, and so there was less to sell. Breeze had realized £138 less, and sulphate of ammonia £411 less. Tar was the only residual which showed an increase; and for this they received £3992, or £529 more. There was an increase of 1689 in the slot-meter consumers; the number of these meters now in use being 16,873. There was also an increase of 2174 in gas-cookers; the number now in use being 16,466. The arrangement for taking in charge and keeping in order incandescent burners and mantles had worked most satisfactorily. The Company undertook to do this work free of expense to the consumer, with the exception of the first cost of the mantles. The man who used these burners and mantles had a more brilliant light, with a smaller consumption of gas, and with less expense to himself; but still there were a large number of consumers who had not as yet availed themselves of the Company's offer, and of the great advantages of the use of incandescent light—the result being that their shops, offices, &c., were badly lighted compared with those of their neighbours who did use the system. The consumers would bear in mind that a further reduction in price of 2d. per 1000 cubic feet came into operation from the beginning of the year. This reduction amounted to £12,000 per annum, which went to the benefit of the consumer. The Board had lost the valuable services of Mr. John R. Wigham, by his recent resignation, caused through serious illness. He had been a Director for over thirty years, and was a practical engineer of great ability.

Mr. MAURICE BROOKS seconded the resolution, and it was carried; and the usual dividends were afterwards declared.

The proceedings concluded with a vote of thanks to the Directors and officers—acknowledged by the Chairman and Mr. Cotton.

PRIMITIVA GAS AND ELECTRIC LIGHTING COMPANY.

The Severance of the Electrical Undertaking.

The Chairman of the above Company (Mr. H. E. Jones) will have a financial statement to present to the shareholders, at their annual meeting next Tuesday, which marks very gratifying progress. The total to the credit of profit and loss account is £115,521. Deducting debenture interest and other charges, there remains a net profit of £83,824, which, added to the balance of £10,289 brought forward, makes £94,113. The sum of £40,000 has been absorbed in paying two dividends of 2s. 6d. per share on the issued preference shares and in putting by a reserve for dividend on the preference shares still to be issued; £2500 has been written off towards amortization of the item "discount on debentures and expenses of issue;" and £15,000 has been placed to reserve account. These amounts total to £57,500; leaving a balance of £36,613 to the credit of profit and loss account. A dividend of 5s. per share (free of income-tax), making 5 per cent. for the year, is recommended on the ordinary shares. This will absorb £20,000, and leave £16,613 to be carried forward.

Regarding the transfer of the electrical undertaking, the Directors report that, last June, they were approached by the Deutsche Ueberseeische Elektricitäts Gesellschaft of Berlin with an offer to take over the electrical section of the Company; and, after very careful consideration of the advantages that would accrue to the shareholders, it was decided to enter into an agreement whereby the entire property of the electrical department has been handed over, on certain conditions, to the Deutsche Company as from June 1 last, in consideration of their making to the Company—for the service of the full amount of £600,000 4 per cent. debentures both as regards interest and amortization—regular semi-annual payments of £15,000 for a period ending on Nov. 30, 1943, at the expiration of which term the debentures will have been extinguished, and an absolute assignment of the property to the Deutsche Company will be executed by the Primitiva Company, who in the meantime retain a lien on the property. One of the Directors, on the invitation of the Deutsche Company, has accepted a seat on their Board to maintain the interests of the Company. The first of the semi-annual payments was made on Nov. 30 last.

BELFAST CORPORATION GAS SUPPLY.

A Satisfactory Year's Working—Thirty Years' Progress.

At the Meeting of the Belfast County Borough Council on Wednesday, Mr. Doran, in moving the adoption of the minutes of the Gas and Electricity Committee, remarked that the 1st inst. was the closing day of another year in the history of the gas undertaking; and doubtless it would be of interest to the Council to know that the returns of gas made showed a substantial increase over those for the preceding year. Owing to the season having been a comparatively open one, and also on account of the large increase in the use of incandescent mantles—not to speak of the competition of electric lighting—many towns where the returns had been made up to December had shown a stationary consumption, or even a decline. In the case of Belfast, the increase for the year had been close upon 4 per cent. (the actual figure was 3·92 per cent.). The figures were as follows: For the year ending March 31, 1904, 1,803,564,000 cubic feet; for the year ending March 31, 1903, 1,735,497,000 cubic feet—increase, 68,067,000 cubic feet. These figures marked the completion of 30 years' working of the concern by the Corporation, who acquired the undertaking on July 1, 1874; one of the previous returns being for nine months only, so as to make the financial year close on the 31st of March instead of the 30th of June, as formerly. The progress during this period had been as follows: Annual make of gas, 1874, 420 million cubic feet; do. 1904, 1803 millions—an increase in 30 years of 1383 million cubic feet, or 330 per cent. At the present initial stage of the prepayment meter venture, it would be impossible to attach much importance to the meagre figures available in connection therewith; but it was encouraging to find that already there were 332 of these meters in actual use, and, in addition, applications had been signed for 261—making a total of 593. It was also gratifying to find that almost all of these were cases in which the customers had not previously been users of gas. The gas consumed through these meters up to the present had been a very small quantity; but no doubt as the use of the appliances supplied with them became better known and appreciated, the returns from this source would be proportionately increased. The minutes were adopted.

GAS AND METER TESTING IN LIVERPOOL.

A portion of the report of Mr. C. R. Bellamy, the Lighting Engineer of Liverpool, on the work of his department in the past year, some extracts from which were given last week (p. 36), is devoted to the above subjects.

The illuminating power of the gas is fixed by statute at 20 candles when tested with a batswing burner consuming 5 cubic feet of gas per hour; the one in use being a No. 7 steatite batswing, approved by the Metropolitan Gas Referees. The gas is tested daily; and, by special arrangement with the Gas Company, the Examiner is empowered to use a Dibdin portable photometer in any part of the city without notice. Mr. Bellamy considers that Liverpool gas may be said to be the most severely tested of any in the United Kingdom as regards illuminating power. Of 316 tests made at the office, the average was 20·31 candles; of 104 made in the district, it was 20·40 candles. The gas was also tested for calorific power, the result being 724·3 B.T.U. per cubic foot gross on an average of 134 tests. So far as purity is concerned, the following figures are the averages found at the laboratory: Sulphur compounds (94 tests), 18·71 grains per 100 cubic feet; ammonia (94 tests), 0·55 grain per 100 cubic feet; and carbonic acid (25 tests), 0·64 per cent. by volume. The gas was entirely free from sulphuretted hydrogen. The foregoing tests were in addition to 468 made at the various works of the Company, which involved 715 visits. There are located throughout the city seven pressure-testing stations, fitted with automatic recording pressure-gauges. During the past year, 2037 visits were paid to these stations; and the maximum pressure recorded was 2·675 inches, the minimum being 1·45 inches. Mr. Bellamy says the records at the seven stations afford satisfactory evidence of equable distribution.

With regard to meter testing, of the 3823 meters of the Gas Company tested, 3684 were certified; of the 754 meters received from various sources, 466 were satisfactory; and of the 690 prepayment meters, 422 were found to be correct. Out of the 5267 meters submitted for testing, therefore, 4572 were passed and 695 rejected. When the Corporation acquired the undertaking of the Electric Supply Company in 1896, the meter-testing work was transferred to the municipal department. The total number of electricity meters tested last year was 2770—the majority (2690) being for 230 volts; and 974 were rejected. The gas-meter testing fees amounted to £226 1s. 9d., which, however, did not meet by £28 18s. 3d. the expenses incurred for wages, without taking into consideration any of the standing charges or the cost of supervision. The fees received for testing the electricity-meters came to £138 15s., in addition to which the department is debited with £220 per annum for maintenance charges.

COWES DISTRICT COUNCIL GAS SUPPLY.

Increased Business Calls for Additional Plant.

At the Meeting of the Cowes District Council last Tuesday, several matters relating to the gas undertaking were under consideration. They came up in a report by the Special Gas Committee, who recommended the sealing of a contract for the supply of coal, and that application should be made to the Local Government Board for power to borrow £4800 for gas-works purposes. The total was made up as follows: Amount expended in excess, £400; new mains, services, and meters, £1050; stoves and fittings, £1400; coal-conveyor, £1300; governor and washer-scrubber, £350; sulphate plant, £300. The recommendation in regard to the contract having been adopted,

Mr. G. FELLOWS (Chairman of the Committee) moved the adoption

of the recommendation in regard to the loan. With reference to the amount overspent, he explained that some 15 or 16 months ago, £800 was borrowed for the purpose of supplying gas stoves and fires. The whole of this amount was absorbed within twelve months, and with satisfactory results, seeing that the gas supplied to consumers by means of prepayment meters had increased by no less than 59·7 per cent. Such an increase was very satisfactory, and proved the policy of the Committee in making the step to be a right one. The £400 had been spent in additional supplies of a similar character. As to the next items, the sums named were required for the provision of mains, fittings, stoves, &c., to meet increasing supplies. Perhaps the most important item of the whole was the £1300 proposed to be expended on a coal-conveyor. Under the present arrangement, when a sailing vessel came alongside the jetty at the works, the coal had to be taken out of the ship, put in bags, and carried on a tramway to the store. The Committee thought it would be advisable to adopt a different policy, and use a mechanical process in the shape of an overhead conveyor, by means of which the coal would be lifted out of the vessels, carried at a high level, and deposited in the store at a low cost.

Mr. LEE: And do a lot of men out of a job.

Mr. FELLOWS said the day had gone by when machinery could be opposed on this ground. At present the coal cost an average of 14s. 1½d. per ton, and porterage another 1s., which made a total of 15s. 1½d. If coal were obtained by steamer, for which purpose a conveyor would be necessary, it would cost 12s. 11d. per ton, 4d. for tubbing in the hold of the vessel, 1d. for conveyance, and 3d. for trimming; making a total of 13s. 7d., or a saving of 1s. 6½d. per ton. This would amount, upon the quantity of coal estimated to be used, to a yearly total of £337 15s., from which had to be deducted the repayment and interest, which had been put at 6 per cent., or £78 a year; leaving a net annual economy of £259 15s. It would assuredly be admitted that such a sum was well worth saving. Having explained the reasons for putting in the new governor and washer-scrubber, he passed to the last item—the sulphate plant. He said that it was their practice to sell the ammoniacal liquor made from time to time; but owing to the cost of carriage from one place to another, they got but little out of it. Last year, 4153 tons of coal were carbonized, and £40 was obtained for the liquor. Newport in the same time carbonized 4336 tons of coal, and, having proper plant, received £87 11s. for the product, after paying all costs. At Sandown, only 1877 tons of coal were carbonized; but, having their own plant, they obtained £43 2s. 2d. for the sulphate of ammonia. These figures were sufficient proof of the necessity for the plant referred to. Though it was not proposed to carry out the whole of the improvements mentioned at once, their desirability—in fact, their necessity—would be understood when he stated that last year the increase in the make of gas was no less than 12¾ per cent. He might further point out that in 1897 the make of gas was 22,354,000 cubic feet; while for the year just ended it was 42,338,000 cubic feet—showing an increase of 19,984,000 cubic feet, or 89½ per cent. With regard to the capital account, though it might be said that the works were over-capitalized—and no doubt they were—yet the greater the business done, the less was over-capitalization apparent. In 1897, it worked out at £21 9s. 2d. per ton of coal carbonized; whereas last year it was £15 19s. 7d. In 1898, the coal used was 2235 tons; last year it was 4153 tons—being an increase of 1918 tons. This was done for an additional capital of £7848, or at the rate of £4 1s. 10d. for every extra ton of coal carbonized. These figures showed the desirability of pushing the consumption as much as possible. Since the works had been taken over, £6605 had been paid off in principal alone; while in three years' time there was a small loan falling in which would relieve the accounts to the extent of £100 per annum. The make of gas per ton of coal during the past three years had been advancing, especially since Mr. Millard took over the duties of Manager. In 1902, it was 9478 cubic feet; in 1903, 9741 cubic feet; and in 1904, 10,200 cubic feet. These figures reflected credit upon Mr. Millard, who, by the improved methods he had introduced, hoped to get even better results in the future. Another satisfactory feature was that whereas in 1897 there were only 740 consumers, there were were now 1567, or an increase of 827. A great number of these were by means of prepayment meters; but, still, they were good customers.

Mr. FELLOWS, C.A., seconded the motion.

Mr. BROWN thought it well to remind the Council that when the resolution to purchase the gas undertaking for the town was moved, those responsible for it clearly pointed out that success or failure must depend upon the progress made in the consumption of gas. Statistics were given at the time proving that the consumption in Cowes was absolutely ridiculous; and the prophecy was made that if the town acquired the works, they would considerably increase, resulting in improvement, both as regards reduced cost and better light. That prophecy had been amply fulfilled.

Mr. SNELLGROVE remarked that there had been so many comments as to the alleged bad bargains made by the town when the gas-works were taken over, that he did not think it could be too frequently pointed out that as yet they had not cost the ratepayers of Cowes a penny; while, on the other hand, a valuable asset was being built up. There was no comparison between the condition of the works now and when they were taken over by the Council.

The VICE-CHAIRMAN pointed out that, including the loan now proposed, the capital sunk in the gas-works would have been increased by £12,000, in round figures, since they were purchased; while only £6000 had been repaid. He expressed the hope that no further loans would be required in connection with the works for some years.

Mr. FELLOWS said he, on the contrary, hoped it would not be long before the Gas Committee came to the Council for their sanction to another loan of a similar character to that now under consideration, as it would prove that good business was being done.

The report was unanimously adopted.

Owing to a scarcity of water in Middlewich, the supply has been cut off between 1 p.m. and 7 p.m.; and it has been withdrawn altogether from the London and North-Western Railway Company.

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LANCASTER CORPORATION GAS SUPPLY.

Effects of Good Management.

At the last Monthly Meeting of the Lancaster Town Council, the result of the working of the gas undertaking in the past financial year was made known.

Alderman HELME, M.P., the Chairman of the Gas Committee, in moving the adoption of their minutes, remarked that at the commencement of the year they hoped to be able to secure a balance of £1531 17s. 9d. for the reserve fund. Though they had lowered the price of gas, as was expected, the sales had been reduced, and they found themselves with a somewhat stationary business. At any rate, they had only held their own with a slight increase of something more than 1 per cent. However, the skilful management of the works in several departments had resulted in exceeding the amount mentioned and in a prospective surplus at the end of the year of £2467 3s. 11d. The receipts from gas were £1786 less than for the year ending March, 1903; and they supplied gas free for the lighting of the streets to the amount of £1500. In spite of the fact that their total receipts would be £2925 less than before, they had reason to be satisfied with the business done; though they had not quite realized the amounts hoped for in the sales of residual products and coke. In considering their position with regard to the contribution towards the rates, they felt the offer they had previously made was one they might continue; and they asked the Finance Committee to be satisfied with a contribution of £1500. It was found that the reserve fund required careful attention. The policy of the Corporation had been to build up, equip, and extend the works so as to supply a larger quantity of gas if it were needed in the town without increasing the capital, by charging the cost of improvements as might properly be done. In March, 1903, the reserve fund amounted to £13,956. But last year they were allowed to spend £3258 15s. 10d. in the renewal and extension of plant; and this reduced the total to £10,343. Since then the Council had sanctioned other alterations, and the provision of mechanical stokers, at a cost of £3500, which had had the effect of further lowering the reserve to £6843. They felt that if they were allowed to put the prospective surplus of £2467 to the fund, while providing gas to the amount of £1500 for the lighting of the streets, they would be in a stronger position, as this would bring the reserve up to about £9000. When, however, the matter came before the Finance Committee, it was found that this could not be done. Speaking for the Gas Committee, he was sure they were desirous to do their best for the welfare of the town; but it must not be understood that the present large sum taken as a contribution to the rates could be accepted as a safe basis for the future.

Alderman BOWNESS, in seconding the motion, said he did so somewhat reluctantly; his own opinion being that, instead of handing over a large sum to the rates, they might very properly have made a reduction in the price of gas, especially as it had always been found that such a step had been followed by increased consumption without additional expenditure. He knew that this was an exceptional year, and that shopkeepers were feeling it very much; and it was mostly out of consideration for them that the Committee had been willing to make the large contribution named. They must, however, consider the safety of the reserve fund; and he believed the Local Government Board insisted that it should be £12,000, in view of the large amount of capital invested.

The minutes were passed.

ISSUE OF STOCK BY THE COMMERCIAL GAS COMPANY.

A Criticism.

The following paragraph is from the "Pall Mall Gazette": "Why the Directors of the Commercial Gas Company should offer, in language as of conferring a favour, new stock at about two points higher than similar stock can be obtained in the market is somewhat perplexing. They state that they desire to give their customers and employees, as well as the shareholders, an opportunity of increasing their holdings in the Company. Accordingly they offer 'allotments of stock at the price of £102 of money for £100 of stock, free of all expenses.' The price of similar existing stock in the Stock Exchange Official List is 97 to 100; so that even if a buyer had to pay the full outside price, it would not cost him more than 101, allowing 1 per cent. for stamp duty and brokerage. Applications are to be received up to April 27, although one might have supposed that a Company like the Commercial Gas could have placed so small an amount as £25,350 stock in less time than a month—the circular having been sent out at the end of March. Payment must be made in full about a week after allotment; and, as a half-year's dividend is due in September, there may be some trifling advantage in this, supposing the price of the present stock to keep where it is now. 'The liability of the shareholders is limited,' remarks this circular—'that is, when the stock is paid for, there is no further liability whatever.' It is difficult to imagine any desperate rush for a stock offered above the market price; and some people seem to think the Directors would have been better advised to have asked not more than par." The writer does not appear to be aware that the smallness of the amount of stock offered is due to the fact that it is merely the unissued balance already authorized by the proprietors; as to the price, some allowance must be made for the fact that the idea is to spread it in small lots as widely as possible in the district, to encourage local interest in the concern; and as to the length of time allowed for applications, the desire of the Directors no doubt is to give the small consumers ample opportunity for applying for it. Persons of slender means such as those whom it is hoped to secure as proprietors in the district of supply are not accustomed to doing things as they are done in the City.

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ENCOURAGING THE USE OF GAS FOR POWER.

Reduction in Price at Bridport.

The Bridport Gas Company announce that as from July 1 next the price of gas used for power purposes will be reduced to 3s. 6d. per 1000 cubic feet. The consumer claiming this concession must have a separate meter supplying only the gas-engine, and must bear the cost of any necessary alterations to pipes, &c.

Appended to the notice is a statement by the Company to the effect that a gas-engine is the cheapest artificial source of power for intermittent use. A modern gas-engine will develop 1-horse power per hour, at a cost of 0·66d., with gas at 3s. 6d. per 1000 cubic feet; while a modern steam plant will furnish 1-horse power per hour at an average cost of ¾d., with coal at 15s. per ton. An electric motor will develop 1-horse power per hour at a cost of 3d., with electricity charged at 4d. per Board of Trade Unit (1000 Watt hours). A steam-engine, with boiler and setting and chimney, costs from two to three times as much as a gas-engine of the same power, and needs at least one man always in attendance on it.

FATALITIES FROM GAS POISONING.

The Chester Coroner last Tuesday held an inquiry as to the sudden death of a widow, 75 years of age, named Jane Hall, who resided at 27, Earl's Villas. At 8.30 the previous Sunday night, she was seen by a lodger sitting in a rocking-chair in her usual health; but when he came downstairs on Monday morning, he found her lying at the bottom of them dead. Dr. Lees, who was called to see the deceased about an hour after her death, said he perceived a strong smell of gas in the house; and the lodger told him that when he came downstairs in the morning and found deceased, the gas-cooker was turned on and unlighted, and the house was full of gas. The postmortem appearances were quite consistent with poisoning by coal gas. As deceased had a weak heart and a feeble circulation, it was shown that a very small admixture of gas (probably from 10 to 12 per cent.) in the atmosphere would have proved fatal in her case. The Jury found that death was due to gas poisoning.

The suicide of a young Jewess named Elizabeth Myers, who was found dead in her cell at Holloway Prison on Monday morning last week, was on Wednesday investigated by a Coroner's Jury. Deceased was sentenced to twelve months' imprisonment in the second division in November last, and had acted so peculiarly that she was sent to the hospital for treatment both of mind and body. Her condition improved, and she was able to work; special observation becoming unnecessary. On the morning in question, she was found dead in bed, completely dressed. She had removed the burner of the gas-bracket, and plastered up with paper all the openings for ventilation in the cell, which was filled with gas, and she was suffocated. A wardress said that between five and six on Sunday evening she tried the cell door in accordance with custom, and two hours later turned off the gas; Myers calling out, "All right." Dr. Griffiths said he had drawn the attention of the Commissioners of the Prison some few months ago to the danger arising from naked gas-lights inside the cells. A change was now being made; the lights being placed behind a thick sheet of plate-glass. The Jury returned a verdict of "Suicide;" adding that there was not sufficient evidence as to the state of the woman's mind.

On the evening of the 30th ult., Mr. John J. Kinsella, aged 27, the Dispenser at the Grand Canal Street Dispensary, Dublin, was suffocated in a bath-room. About 8.45 on the evening named, the deceased was seen by Mrs. Grant, the caretaker, removing his boots in his sitting-room. She left the dispensary on business, and when she returned a short time afterwards he was locked in the bath-room, and made no reply when she called him. There was a strong smell of gas at the time. She told the porter, who forced his way into the room, and found Mr. Kinsella lying on the floor apparently dead. He procured assistance, put Mr. Kinsella to bed, and sent for a doctor; but when he arrived he pronounced life extinct. At the Coroner's inquiry, Dr. M'Weeney stated that death was due to suffocation resulting from the inhalation of carbon monoxide. He noticed in the bath-room an apparatus for heating water. It had six bunsen burners under it, which would, of course, deliver a large quantity of gas. He had not the slightest doubt as to carbon monoxide being the cause of death; and it might have been produced by one or more of the burners lighting-back, the effect of which would be to discharge unburnt or partly burnt gas into the room. He considered the apparatus in the bath-room highly dangerous in its present condition, because there were no means, such as a flue, for carrying off the products of combustion The Jury found that death resulted from suffocation caused by the inhalation of carbon monoxide gas, the presence of which was due to an imperfectly ventilated hot-water apparatus.

Gas Stokers for Naval Reserves.—The first batch of gas stokers for the Royal Naval Reserve has lately been enrolled at the Mercantile Marine Office, Newcastle-on-Tyne. A local paper says that "the men are of splendid appearance and physique, and have the highest testimonial from their principals at the local gas-works where they have been employed." The age for entry is from 21 to 35, and no previous sea service is necessary. This special class receives an annual retainer of £6; and the Admiralty hope that, when the advantages of the scheme are understood, the stokers employed in gas and electric light factories and other works in the different industrial centres will gladly join the new force. During their training period of three months, the men receive the usual pay and allowances (with half pay to their families, if desired) of naval stokers.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Waverley Association of Gas Managers have been the first of the Scottish bodies to meet after the winter season. Their meeting at Dunbar on Thursday was a quiet gathering. In point of numbers it was not so large as I have seen. With regard to the matter before the members, this, of course, according to custom, had its source in the address of the President. Mr. Blair's remarks were so well directed, that the discussion which followed never got off the rails, as sometimes happens, when either the President fails to lead or some assertive one snatches the leadership from him. Neither of these things having happened at Dunbar, the meeting was in reality led by the President, and to good purpose. An unusual experience was the presence throughout the whole day of Provost Gibb and Bailie Smith—the latter the Convener of the Gas Committee of the Corporation. The usual practice is for the representatives of the local corporation or gas company to have their say and leave the meeting to conduct the business in its own way. But these gentlemen were intent upon learning all they could; and they remained to the end of the day's proceedings. They were very pleasant gentlemen, and if they make use of the knowledge they acquired at the meeting for the benefit of the gas undertaking—which, on all grounds, they are likely to—their devotion to duty will have its reward. There was no excursion. This, however, in the circumstances, was not to be regretted, because the wind was so high that it would have been anything but comfortable to have gone out driving. Dunbar is a town which has scarcely any industry. Even the fishing industry, which used to be the staple, has, in these days of steam trawling, left for larger ports. Some years ago the town was rapidly declining. It has now taken a new lease of life, through the instrumentality of the game of golf and its reputation as a health resort. It has an atmosphere of a purity which is not found in many places. This was experienced on Thursday, when, from the hotel, the vista to the north was only closed in by the snow-clad peaks of the Grampians in the county of Kincardine, some sixty miles away.

The lighting of the streets of Edinburgh is not going to be so easily improved as last week's "Note" gave promise of. It was only a Sub-Committee who resolved upon the incandescent gas system. When the proposal came before the Cleaning and Lighting Committee on Monday, and they learned that the cost of conversion was to be about £20,000, and the annual increased cost about £5000, they were not so enthusiastic as the Sub-Committee had been. They are, it appears, experimenting with a burner consuming 2 cubic feet of gas per hour—the present consumption—in a square lantern; and they are anxious to ascertain how it is to turn out, because, if it should be a success, there would not be much of an annual increase in cost. The 2-feet burners, it is considered, would be suitable for quieter thoroughfares; and 3-feet jets could be used in busier roadways. The Committee ordered the report of the Inspector of Lighting (Mr. G. A. D. Mackay) to be printed and circulated, and adjourned consideration of the subject till Monday. The report has been published to-day. In it the Inspector states that, with a view to avail themselves of the experience and suggestions of Glasgow, he and the Sub-Committee visited that city on the evening of the 8th of March, when they were received by the lighting representatives and their officials, and everything was done to facilitate and promote the object of the visit. They were driven over the quarters of the city where incandescent lighting is in use, and were afforded every opportunity of judging of its effects. The consumption of gas per burner varied from 2·8 to 4 cubic feet per hour. Both lanterns and globes were in evidence. The ordinary globe lamp lighted incandescently, however, while showing some improvement over the flat-flame burner, was not considered satisfactory by the Glasgow representatives, who intimated their intention of having it displaced by a lantern. The Edinburgh deputation felt convinced that this was in the right direction; and they signified their approval. The result of the visit to Glasgow was to impress the Sub-Committee very favourably as to the merits of incandescent lighting. Since then the Edinburgh Committee have been favoured with copies of a report on a recent visit of a Glasgow deputation to other places for the purpose of inspecting and reporting on the lighting of the public streets. The main outcome of the report is a recommendation that incandescent gas lighting should be adopted all over the remaining parts of the city. In Edinburgh the number of ordinary gas-lamps is 10,141, of which 446 are incandescent; leaving 9695 to be dealt with as the Committee may recommend. The Gas Commissioners' charge for the conversion of the lamps, based on their account for the recent incandescent installation, would be 47s. 5d. per lamp. Under the Lighting Department the work could be done at the rate of 44s. 11½d. per lamp. By the Gas Commissioners the total cost of conversion would be £22,985, and by the Lighting Department £21,783. An economy would be effected under the latter, which, with nothing beyond the services of an additional gas-fitter, could overtake all that is required, and the cost of unpacking and cartage would be avoided. The expense of converting so many lamps, if carried out forthwith, would be a serious financial undertaking; but if effected by a series of yearly instalments, it would be less felt. If the expenditure of £21,783 were spread over five years, the permanent annual increase in the cost of the department would be £5675. This estimate is based on the assumption that the price of gas is to be reduced from 2s. 5d. to 2s. 1d. per 1000 cubic feet. It is important to note that the square lantern is more durable and economical than the globe form. The excess cost of incandescent lighting over that of the ordinary gas-lamp is known to be in some places less than in Edinburgh. This, however, is only apparent; the explanation being that, previous to incandescent conversion, a burner consuming a large quantity of gas had been in use, with the result that there is no charge for extra gas. With the view of ascertaining whether, with an economy in gas, the cost of incandescent lighting

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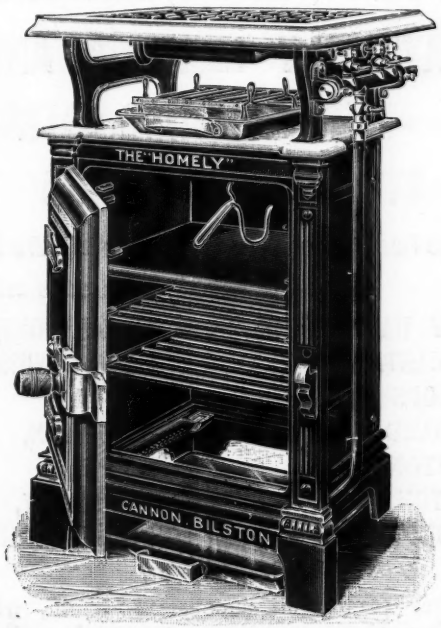

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might not be still urther reduced, the department are experimenting with a square lantern having a 2-feet instead of a 3-feet burner. It is yet too early to pronounce definitely on the result; but, so far, the experiment promises well. It is clear that, at least for some of the less frequented side streets, it would be a considerable improvement on the ordinary gas-lamp. With such lamps, consuming one-third less gas, the cost for the first year would be 36s. 9d. per lamp, and the annual increase thereafter 3s. 6d., as against 11s. 8½d. In estimating the cost of incandescent lighting, nothing has been included for adding to the lamp-lighting staff; but it is evident that some little provision of this kind will have to be made, as incandescent gas-lamps require more attention than the ordinary kind. It had been suggested to the Committee by Mr. Mackenzie that in certain districts of the city the improved lighting aimed at might be effected by electric instead of incandescent gas lighting. The proposal, however, while on the surface showing a cheaper method of electric lighting than that which obtains in the electrically lighted areas, was found on examination to be unacceptable, on the ground that while, up till now, each of the arc lamps has, on the average, been placed so as to cover the area which had been occupied by 3½ gas-lamps, the intention was to place them farther apart, with the result that each of the arc lamps would displace, not 3½, but 5·04 gas lamps—an arrangement which would fail to give satisfactory lighting results. To light the whole city with electricity would involve a permanent annual addition to the lighting expenditure of about £13,000; and the corresponding figure for incandescent gas would be, as stated, £5675.

The subject of the extraordinary deadlock which prevents the Corporation of Dundee from shipping coke at the harbour, 50 yards from the gate of the gas-works, and compels them to send it by rail to other ports for shipment, came before the Town Council on Thursday. Bailie Melville said the Gas Committee had not come to any resolution as to what should be done; but he anticipated that they would take some step in regard to the conduct of the Joint Railway Company. He thought it was high time the Council should take some decided action to ascertain the position the Railway Company were taking up against several of the best interests of the city. The Council were simply being boycotted. Their coke export was being brought to a standstill unless they sent it over the railway to another shipping port. He thought the matter should be submitted to the Railway Commissioners, and that the Town Clerk should be instructed to make inquiries as to the means of bringing the conduct of the Railway Company before the proper authorities, in order that they might know how they stood. He moved to this effect; and the Council agreed to allow the Town Clerk to report on the matter to the Gas Committee. We shall now see what he has to say. But surely the Town Council, who own the harbour railway lines, have power to do for themselves what it is suggested they should ask the Railway Commissioners or the Board of Trade to do for them.

The Town Council of Aberdeen yesterday paid a visit of inspection to the gas-works. They were received by the Engineer and Manager (Mr. S. Milne), and were shown round by him. They witnessed the operation of quenching the coke, in connection with which, it may be remembered, a remit was recently made to the Gas Committee to consider the expediency of covering in the coke yard, in the interest of the comfort of the workmen. The councillors, it is reported, were greatly impressed by the cloud of steam and sulphurous smoke which was emitted. Continuing their tour, the working of the mechanical stokers (West's) was looked at with interest, as were also the regenerative furnaces. The working of all the parts of the plant was explained by Mr. Milne, Mr. Kemp (the Convener of the Committee), or Mr. J. Tait (the Superintendent of the staff). After the inspection, the councillors were served with refreshments in the drawing office. Bailie Meff, who presided, proposed the toast of "The Continued Prosperity of the Gas Department and the Committee." He said they all regretted the absence of Lord Provost Walker, who, he was certain, would be disappointed at not being present, more especially as this was the first inspection since Mr. Milne had been appointed Manager. This appointment was a unanimous one, and was, he believed, due to the fact that Mr. Milne was well known to most of the members of the Council, had been associated practically all his lifetime with the gas-works, had been brought up under the guidance of Mr. Smith, who was one of the best public officials they had ever had in connection with the Corporation, and had thereby received an excellent training. It must be very gratifying to the members of the Council to see the thorough grasp Mr. Milne had of the work. It was thought at one time that as the Electricity Department went on increasing there would be a decrease in the Gas Department; but such had not been the case. He coupled with the toast the name of Mr. Kemp, whom he described as a most able Convener. Mr. Kemp, in acknowledgment, gave an historical narrative of the gas supply of the city, and went on to say that there were in the works 468 retorts, of which 36 were on the inclined system. Last summer a trial setting of 16 retorts was erected upon what was considered to be an improved design, with the view of effecting a better distribution of the heat along the whole length of the retorts, and at the same time reducing the temperature of the under-floor of the retort-house. The essential feature of the system was that the producer was built for the most part right into the setting, instead of standing out quite clear of it. By this arrangement, comparatively little heat was lost by radiation, and the temperature of the sub-chamber was therefore materially reduced. The effect would not, however, be fully appreciated until the whole of the settings had been converted to the improved design. At the present time only 64 had been altered, and 160 more were under way. Other advantages accruing to the design were that there was a reduced consumption of fuel, and better and more equable heats; and a small stream of water was used to effect the same purpose that live steam did in the old type. With the new system, it had been found that there would be no difficulty in getting the retorts to run two winters at least, whereas under the old one 25 per cent. of them had to be renewed after one winter's service. After a

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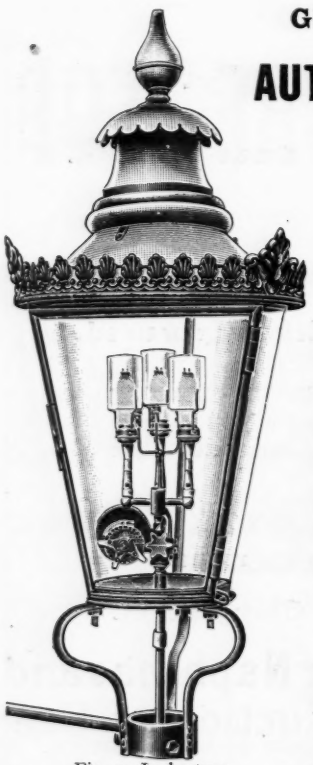

Fig. 2. In lantern.
Automatically operates cluster of burners with midnight arrangement at required hours daily for one week with one setting.
Adaptable to any number or kind of burners.

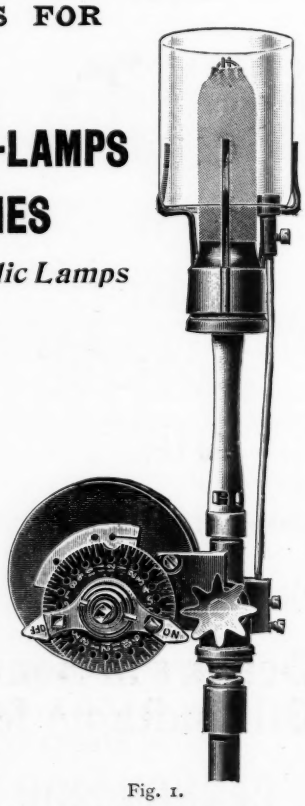

Fig. 1.
Automatically lights and extinguishes a single burner at the required hours daily for one week with one setting.
Adaptable to any kind of burner.

feeling reference to their late Gas Engineer, Mr. Smith, who, he said, literally lived for and in that place, and had not been forgotten by those who knew him best, Mr. Kemp said they had with them that day for the first time in that capacity their new Engineer, Mr. Milne, who had, by his own personal worth, earned the confidence of the entire Council. As some of them had noticed that day, he had already made his mark on the establishment, with very satisfactory results. He concluded by proposing the toast of "The Gas Engineer and the Resident Superintendent (Mr. Tait)." Mr. Milne, in acknowledging the toast, said he felt very much the absence of their highly esteemed and respected friend Mr. Smith, whose remembrance he would cherish with the deepest feelings, for he owed much to him, as a wise counsellor.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 9.

Sulphate of Ammonia.

Notwithstanding the holidays, demand has been sustained, and prices remain as last quoted—£12 10s. per ton f.o.b. Hull, and £12 11s. 3d. to £12 12s. 6d. per ton f.o.b. Liverpool and Leith. Shipments in March have been only slightly less than those in the same month of 1903, and the total exports for January-March only about 500 tons less than those for the corresponding period of last year; so that the stock in makers' hands brought forward into April cannot be very large, while, on the other hand, the season on the Continent and in the United Kingdom is several weeks later than 1903. The forward position is neglected; and, although spot prices would be accepted for April-June, buyers remain indifferent.

Nitrate of Soda.

Nitrate of soda deliveries in Europe, owing partly to unfavourable weather and partly to extreme prices reached, have been about 50,000 tons less than those for March, 1903, which were exceptionally heavy; but more favourable weather and easier prices have brought about improved demand, and deliveries for the month promise to exceed those for April of last year. Local prices remain 10s. 1¼d. to 10s. 4½d. per cwt., according to quality.

LONDON, *April* 8.

Tar Products.

There has been little business doing in tar products during the past week; markets generally remaining in a very quiet state. Prices for pitch are practically the same, so far as England is concerned; but lower rates are being accepted in Belgium and France, several small sales having been made both for prompt and forward delivery at prices under those ruling some few days ago. There has been some inquiry from South Wales; but consumers do not seem disposed to pay the prices asked by dealers and makers, evidently believing in a still further reduction in value. Some small quantity of 90 per cent. benzol has been sold for home consumption; but for 50-90 per cent. there is really no inquiry. The position of solvent naphtha remains unchanged; and there is an absence of demand both for export and home consumption. There are a few inquiries for forward delivery; but the prices mentioned are so low that makers do not care to entertain same. There is no business of importance to advise in creosote. Makers in the North seem rather more anxious to sell, especially for early delivery; but in London the difficulty in obtaining barrels prevents business being done for export. There is nothing fresh to advise in anthracene; no business having been reported this week for either prompt or forward delivery. The position of crude carbolic acid remains the same. Makers as a rule hold out for 2s.; while consumers report buying from dealers at 1s. 10d. and 1s. 10½d., without difficulty, both for prompt and forward delivery. In crystals, there does not appear to be very much doing. German manufacturers are anxious to secure business for forward delivery, but do not appear to be able to spare anything of importance before June. There is a general impression that the price of crude may improve a little later; and a steady business at 2s. may be expected, provided there is no speculative attempt to raise the price above this.

The average values during the week were: Tar, 18s. to 23s. Pitch, London, 33s. 6d. to 34s.; east coast, 32s. 6d. to 32s. 9d.; west coast, 31s. 6d. to 32s. Benzol, 90 per cent., 9½d. to 10d.; 50-90 per cent., 7d. Toluol, 6½d. to 7d. Crude naphtha, 3d. to 3½d.; solvent naphtha, 7d. to 8½d.; heavy naphtha, 10d. to 10½d. Creosote, London, 1 15/16d. to 1 11/16d.; North, 1¼d. Heavy oils, 2¼d. to 2⅝d. Carbolic acid, 60 per cent., 1s. 10d. to 2s. Refined naphthalene, £5 to £8; salts, 22s. 6d. to 24s. Anthracene, "A" quality, 1⅜d. to 2d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The sulphate of ammonia market is very quiet; and there is really nothing doing for either prompt or forward delivery. The Gaslight and Coke Company still maintain their price at £12 15s. in any position; but buyers will not entertain business at this figure. At Hull, a small quantity is reported to have been placed at £12 10s. for prompt shipment; but as a rule makers ask £12 11s 3d. to £12 12s. 6d. for forward delivery, which consumers are not at all prepared to pay. There is absolutely no business in Leith. Buyers offer £12 10s.; but sellers hold at £12 11s. 3d. to £12 12s. 6d., according to quality and position. Some small transactions are reported from Liverpool at £12 8s. 9d. and £12 10s., according to quality and period of shipment.

Entertainment to Southport Gas Officials.—In connection with his retirement from the position of Gas Engineer to the Southport Corporation, Mr. John Booth entertained the works officials at dinner at the Queen's Hotel, on the 31st ult. Subsequently there was a reception, and a social party was held; the evening being enjoyably spent with musical selections. A vote of thanks was passed to Mr. Booth for his kindness, and references were made to the good feeling that had always existed between him and the members of the staff.

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COAL TRADE REPORTS.

Lancashire Coal Trade.

For some time past there have been numerous complaints that the Yorkshire and Derbyshire collieries were cutting into the Lancashire markets, and securing a good deal of the local trade; but it was generally thought that this competition would, for the present at least, be met by special concessions where the business of customers was being directly attacked, and that house-fire coals might possibly get through the summer, or at any rate later on in the year, without any officially quoted reduction. Quite unexpectedly, however, the Associated Manchester Coalowners, at a special meeting held just prior to the holiday stoppages, decided upon an all-round reduction of 10d. per ton upon both house-fire coals and nuts. This reduction came altogether as a surprise to the colliery owners in the other Lancashire districts; and at a meeting of the West Lancashire Coalowners' Association held on Tuesday, it was decided that a similar reduction should be made where they had to meet the competition of the Manchester district, but that otherwise list rates should for the present remain unchanged. The action of the Manchester colliery owners necessarily, however, has a weakening effect generally. Their quotations for house-fire coals now average about 14s. 6d. to 15s. per ton at the pit for best qualities, 12s. 6d. to 13s. 6d. for seconds, and 9s. 6d. to 10s. 6d. for common. In the West Lancashire district, best Wigan Arley coals scarcely average more than 13s. to 14s. per ton, seconds Arley and Pemberton four-feet 11s. to 12s., and common 9s. to 10s. Common round coals for steam and forge purposes remain without quoted alteration, but generally weak. They do not average more than 7s. 9d. to 8s. 3d. per ton for the lower sorts, up to 8s. 6d. and 8s. 9d. for the better qualities. One or two contracts for gas coals are reported to have been settled during the past week. The actual prices have not transpired; but it is understood that buyers have been able to obtain some concession upon last year's rates. For engine classes of fuel there is a moderate sort of inquiry, with prices about steady at late rates. The best descriptions average 6s. to 6s. 6d. per ton at the pit, medium 5s. to 5s. 6d., and common from 3s. 9d. up to 4s. 3d. and 4s. 6d. For shipment, there is only a very indifferent inquiry, with common steam coals delivered at ports on the Mersey or the Manchester Ship Canal readily obtainable at 8s. 9d. to 9s. 3d., and better qualities quoted 9s. 6d. up to 9s. 9d.

Northern Coal Trade.

The coal trade of the North is now fairly brisk; and the demand for the Baltic is beginning to set in, so that it will soon make up for any falling off in the home consumption that the warmer and longer days may cause. In the steam coal trade, this is the more marked. The best collieries are fully employed; and the demand is keen in contrast with that of a few weeks ago. Best Northumbrian steam coals are 10s. to 10s. 3d. per ton f.o.b., second-class steams are about 9s., and steam smalls are from 4s. 6d. to 5s. 3d. In the gas coal trade, the deliveries for home use are smaller; but the exports are increasing. More of the great contracts are now in course of arrangement. Those of the Commercial Gas Company are practically settled on a similar basis of price to those of the South Metropolitan Company. The Gaslight and Coke Company's supply is under offer; and it is expected that the prices that will rule will be from 7s. 6d. to 8s. per ton f.o.b., or equivalent rates for coal delivered. The exact price, however, will be known in a few days. Gas coke is steady; from 13s. to 13s. 6d. per ton f.o.b. being quoted this week. Production is falling, and exports are good; so that the stocks should soon be reduced.

The "Newcastle Chronicle" on Saturday contained the following remarks on the subject of the large gas coal contracts: "The greatest of the gas coal contracts are now being negotiated for the year. Of the three Gas Companies which supply the Metropolis, one has entirely arranged its contracts, and a second and smaller one has practically settled those for its supply; while the third has yet to fix for a quantity that may be roundly put at about 2 million tons. There are some slight differences in the method—one of the Companies favouring the purchase of coal at the port of shipment, and another delivered on the Thames; but it may be said that there will be a saving to the Companies, through cheaper coal and lower freights, of probably 6d. per ton, which in the case of the largest Companies points to a saving of roundly £50,000 a year. The prices of gas coals are now coming nearer to the rates they were at before the uprush in the values four years ago; but the conditions of working are very different from what they were. It is noticeable that the cost of carriage by sea is back to its old low rate; but the price of gas coal is considerably above what it was six years or so ago. . . . Still, the Companies have the best gas coal at lower prices than have been known for some years; and they are benefiting to a considerable extent, as the instance given shows."

Scotch Coal Trade.

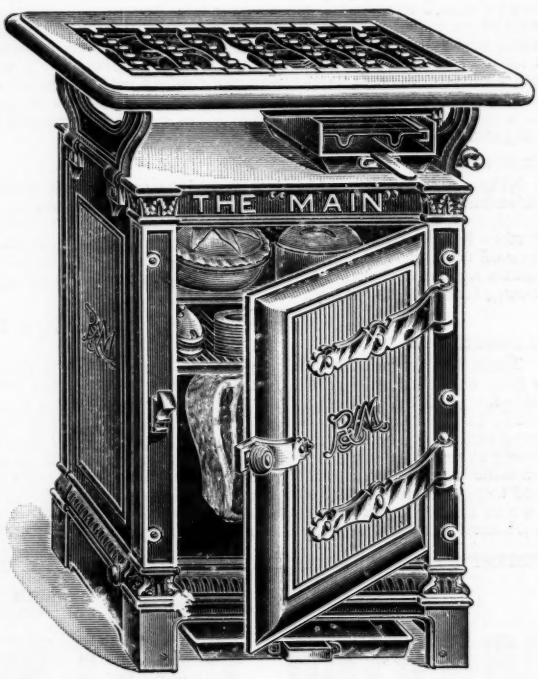
There is still a firmer tone in the market, arising from an improved demand and the expectation of a revival in the foreign trade. Prices are, however, stiff to move. A large number of gas undertakings are inquiring after their coal supplies for next year. The fixing of them will do much to settle the figure at which coal will be had by the general purchaser during the year. Such contracts as have been already fixed are at prices slightly lower than last year. The present quotations are: Main 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow, ell 8s. 3d. to 9s. 3d., and splint 8s. 6d. to 8s. 9d. The shipments for the week amounted to 238,628 tons—an increase of 20,794 tons upon the preceding week, and of 29,377 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,457,178 tons—an increase of 8921 tons on the same period of 1903.

Messrs. Henry Balfour and Co., Limited, of Leven, Fife, have secured the contract for the erection of an oil-tank in connection with the installation of carburetted water-gas plant which is about to be placed in the Corporation Gas-Works at Dundee.

The "MAIN"

Gas Cooker

WITH LATEST DEVELOPMENTS.



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Inside Fittings, Porcelain Enamelled.

Can be supplied with Moveable Burners, if desired.

ORDERS DESPATCHED SAME DAY AS RECEIVED.

R. & A. MAIN, LTD.,

LONDON: 49, Queen Victoria Street. | GLASGOW: 26, West Nile Street. | FALKIRK: Gothic Works.

Costs of the Chard Gas-Works Purchase.—The Solicitors' bill of costs in the matter of the gas-works purchase was presented at a meeting of the Chard Town Council last Thursday. The total was £1900. Mr. Townsend, commenting on the largeness of the sum, said the promoters of the purchase had predicted that the cost of opposing the Gas Company's Bill would only amount to £250, whereas it had run into £900. Alderman Mitchell admitted that the costs had exceeded any anticipations they might have had on the subject; but the fact was that the expense of Private Bill legislation was disgraceful. He hoped, however, that when the purchase was completed it would be found that the town had acquired an asset of great and increasing value. It was decided to pay a further sum of £400 on account of the costs, and to have the bill taxed.

It is reported that there is a deficiency of £10,800 on the account of the Southport, Birkdale, and West Lancashire Joint Water Board for the past twelve months. Southport's proportionate contribution to this amount is £8566, and Birkdale's £2244; necessitating a call on the rates of 6d. in the pound.

Messrs. H. Greene and Sons, Limited, of Blackfriars Road, have received a yearly contract for lanterns from the London and South-Western Railway Company, and a yearly contract for general supplies to the City of Westminster. The same firm have also recently installed incandescent gas lighting at Wilmington Church, Dartford.

Mr. John Ellis, collector in the Gas Department of the Belfast Corporation, in whose service he has been since 1874, has had to resign, owing to bodily and mental infirmity. The Gas and Electricity Committee at first proposed to recommend the Council to grant him a pension of £52 a year; but the figure was reduced to £40. On this coming up at the monthly meeting, Alderman M'Cormick moved that the amount be increased to £80 per annum; and this was agreed to.

Under the auspices of the Great Marlow Gas Company, Limited, whose mains were recently extended to supply the popular river-side resort of Bourne End and the Wooburn and Hedsor district, an exhibition of gas cooking and heating appliances was held by Messrs. Fletcher, Russell, and Co., Limited, at the Bourne End Council Schools during the past week, when a course of lectures on cooking by gas was given by Miss Helen Edden to daily increasing audiences. Messrs. T. Glover and Co exhibited a transparent pre-payment gas-meter; and Messrs. A. E. Podmore and Co. displayed their incandescent self-intensifying lamps both inside and outside the schools. The contrast between the brilliant lighting afforded by this system and that furnished by the oil-lamps still used at the Bourne End Station, though the gas-mains cross the Railway Company's lines at the spot, was freely commented upon by residents in the district. At the conclusion of the lectures, Mr. G. R. Ward, the Chairman of the Marlow Gas Company, presented Miss Edden with a silver casket as an acknowledgment of the Directors' appreciation of the assistance she had rendered in connection with the exhibition.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS AND ELECTRICITY ENGINEER. Malvern Urban District Council. Applications by April 23.
GENERAL WORKING FOREMAN. No. 4192.
MANAGER. Bridport Gas Company. Applications by April 19.

Pupil Wanted. No. 4188.

Situations Wanted.

ASSISTANT-MANAGER. No. 4178.
MANAGER OR MANAGER AND SECRETARY. No. 4189.
RETORT WORK. M., 53, Harleyford Road, Vauxhall S.E.

Plant, &c., for Sale.

CONDENSER (250,000 feet). Redditch Gas-Works.
EXHAUSTER AND ENGINE. Chorley Gas Department. Tenders by April 19.
GASHOLDER. Staines and Egham Gas Company. Tenders by April 8.
PURIFIERS, &c. Blyth and Cowpen Gas Company.
PURIFIERS, SCRUBBER, WASHER, GOVERNOR, STATION METER, RETORT IRONWORK, &c. No. 4193.

Cannel Ash Wanted. No. 4194.

Company Meeting.

IMPERIAL CONTINENTAL GAS ASSOCIATION. Cannon Street Hotel. May 3. 2 30 o'clock.

Sales of Stocks and Shares.

LOWESTOFT WATER AND GAS COMPANY. April 25
NEWCASTLE AND GATESHEAD GAS COMPANY. April 13.
SOUTHEND WATER-WORKS COMPANY. April 25.
TOTTENHAM AND EDMONTON GAS COMPANY. April 25.

TENDERS FOR

Coal and Cannel.

ASHFORD GAS DEPARTMENT. Tenders by April 20.
BRENTWOOD GAS COMPANY. Tenders by April 29.
KIDSGROVE GAS COMPANY. Tenders by April 30.
RICKMANSWORTH GAS COMPANY. Tenders by April 27.

Inclined Retort Installation, &c.

MANCHESTER GAS DEPARTMENT. Tenders by April 21

Pipes, &c.

LEEDS GAS DEPARTMENT. Tenders by April 25.

Purifiers.

SALISBURY GAS COMPANY. Tenders by April 18.

Reservoir and Retaining Wall (including Pipes, Valves, &c.).

BRADFORD CORPORATION. Tenders by April 28.

Retort Fittings.

LEEDS GAS DEPARTMENT. Tenders by April 25.

Sulphuric Acid.

BURY GAS DEPARTMENT. Tenders by April 18.

Tar, Ammoniacal Liquor, &c.

BRIDGEWATER COAL OFFICE, MANCHESTER. Tenders by April 16.
COLNE GAS DEPARTMENT. Tenders by April 18.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract), 1,800,000 C. Ft. HAMILTON, ONT., 400,000 C. Ft.

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O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS.

Correspondence invited.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.

BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.

MELROSE CYCLES and Slot Copper COLLECTORS. Latest Design and lowest Prices. For Cash or gradual payments. Catalogue free.

MELROSE CYCLE COMPANY, COVENTRY.

"NUGEPE" CEMENT.

JOHN E. WILLIAMS AND CO.,

VICTORIA PAINT WORKS, MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE.

THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.

Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are pre- pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

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Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

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APPLICANTS for the position of Fore- man Fitter as advertised are THANKED, and informed that the vacancy IS NOW FILLED.

BRICKLAYER wants re-engagement for RETORT WORK, Generators and Regenerators. Results Guaranteed. Piece or day.

Address M., 53, Harleyford Road, VAUXHALL, S.E.

APPOINTMENT wanted as Assistant- MANAGER in Gas-Works. Trained at Engineering Works. Recently prepared Drawings and Superintended erection of large up-to-date Gas-Works. Good knowledge of Chemistry and Gas-Works Routine. Honours Gas Manufacture.

Address No. 4178, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

APPOINTMENT Wanted as Manager, or MANAGER and SECRETARY, of Gas-Works. Has had Colonial Experience. Thoroughly Practical from Retort to Burner, including Erection and C. W. Gas Plant. Past success guarantee for future. Unexceptional References for character and ability. Honours City and Guilds Examination. Will go anywhere.

Address No. 4189, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
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THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.

General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.

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General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

COAL GAS TAR wanted.

ROBINSON BROTHERS, LIMITED. Works: WEST BROMWICH, KNOTTINGLEY, and SPONDON.

WANTED, by a Gas Company in the North-West of England, a General WORKING FOREMAN, for a Works making about 55 Millions. Must understand Generator Furnaces, Manufacture of Sulphate of Ammonia, be capable of Taking Charge of the Works in the absence of the Manager, and be a Reliable Man. Total abstainer preferred. Salary £90 a year.

Apply, by letter, stating Age, Experience, and enclosing three Testimonials, to No. 4192, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SUPERINTENDENT OF DISTRIBUTION DEPARTMENT.

AN Important Suburban Gas Company intend appointing a thoroughly competent SUPERINTENDENT of their Distribution Department. He must be technically qualified for such a position, be a good organizer, and capable of reporting to, and carrying out the requirements of, the Engineer.

Applications—giving full Particulars as to Experience, to No. 4195, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.—will be treated in confidence.

GAS-WORKS MANAGER.

THE Directors of the Bridport Gas Company, Limited, invite APPLICATIONS from suitable persons for the above position. The annual make of Gas is 23 Millions; and the Salary paid will be £150 per annum, with House, Coal, and Gas free.

Applicants must be over 25 and under 40 years of age, they must have had a sound Commercial Training, and have had Experience in the Management of Gas-Works and a Gas-Fitting business; also must have had good Experience in the Manufacture of Gas on the most approved methods, and be perfectly conversant with the Management and Working of Regenerative Fired Retorts, and the Manufacture of Sulphate of Ammonia.

Applications, endorsed "Manager," stating Age, Qualifications, Experience, and when able to take up the duties, accompanied by *copies* of not more than Three recent Testimonials, to be addressed to the Chairman, Bridport Gas Company, Limited, Bridport, and sent in not later than Tuesday, the 19th inst.

Canvassing the Directors, either directly or indirectly, will disqualify.

By order,
J. H. CORNISH,
Secretary and Manager.

AMENDED ADVERTISEMENT.

MALVERN URBAN DISTRICT COUNCIL.

GAS AND ELECTRICITY ENGINEER.

THE Council invite Applications for the appointment of GAS ENGINEER and MANAGER, and ELECTRICAL ENGINEER, at a Salary of £400 per Annum, with House, Coal, and Gas.

Candidates must have had practical experience in the management of Gas-Works with Inclined Retorts and Coal-Breaking and Elevating Machinery, and also thoroughly understand the manufacture of Sulphate of Ammonia. The make of Gas is about 130 millions.

Candidates must also have had Experience and have been a properly trained Electrical Engineer, and accustomed to an Alternating Current Station.

The person appointed will be restricted from engaging in private practice, and will be required to devote the whole of his time to the duties of his office.

Applications, endorsed "Gas and Electricity Engineer," stating Age, Qualifications, and Experience, and accompanied with *copies* of not more than Three recent Testimonials, addressed to me at the under-mentioned Office, not later than Saturday, the 23rd day of April, 1904.

Canvassing members of the Council, either directly or indirectly, will disqualify.

H. L. WHATLEY,
Clerk to the Council.

Council Offices,
Malvern, March, 1904.

OXIDE OF IRON.

(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL.

5, CROOKED LANE, LONDON, E.C.

COAL GAS TAR wanted.

BEST PRICES GIVEN.

SHARPNESS CHEMICAL COMPANY, LIMITED, Sharpness Docks, GLOS.

SULPHURIC ACID.

SPECIALLY prepared for the Manu- facture of SULPHATE OF AMMONIA.

SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.

Telegrams: "HYDROCHLORIC, LONDON."

Telephone: 341 AVENUE.

THE Engineer and Manager of a Gas- Works in the North of England, making about 300 Million cubic feet per annum, is open to take a PUPIL with premium.

Address No. 4188, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a few Trucks of Cannel Ash in Durham and Yorkshire for cost of loading.

Apply, by letter, to No. 4194, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CONDENSER for Sale. In splendid Condition. Cheap. Capacity 250,000 Cubic Feet per Twenty-four hours.

Apply to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

TO BE SOLD—New Single Gasholder, 50 feet diameter by 15 feet deep, with Six Wrought-Iron Standards, top Ties, and Suspension Gear if needed. Ready for erection.

Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

FOR SALE—GASHOLDER AND TANK.

SPECIAL opportunity for the purchase of GASHOLDER, 40,000 feet capacity, in strong CAST-IRON TANK. Will be refixed cheap to an immediate customer; prompt removal being essential. Full Particulars on application.

J. FIRTH BLAKELEY AND CO., Gas Engineers, Thornhill, DEWSBURY.

PURIFIERS.

THE Blyth and Cowpen Gas Company have FOR DISPOSAL a set of Four PURIFIERS each 10 feet square, with 10-inch Connections, Dry Faced Centre and Check Valves, Girders, and Lifting Gear for same. Erected by R. Dempster and Sons, Elland.

Offers to A. C. FAWCETT, Secretary to the Company, Blyth, NORTHUMBERLAND.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill DEWSBURY

FOR SALE, Cheap, the following good Second-Hand Gas Plant:—

LIVESEY'S PATENT WASHER to pass 250,000 cubic feet per diem. 8-inch Connections.
COCKEY'S PATENT WASHER to pass 100,000 cubic feet per diem. 6-inch Connections.
KIRKHAM'S PATENT WASHER to pass 150,000 cubic feet per diem. 5-inch Connections.
W.I. SCRUBBER, 20 feet high by 3 feet diameter.
Two 8 feet square PURIFIERS, with 8-inch Valves complete.

Also various other GAS PLANT. Inquiries invited.

Apply to SAMUEL WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

STAINES AND EGHAM GAS COMPANY LIMITED.

GASHOLDER FOR SALE.

THE Directors invite Tenders for the purchase (Buyer to dismantle and remove) of a TELESCOPIC GASHOLDER, 50 feet diameter, Two Lifts 18 feet, Eight Cast-Iron Standards, Intermediate Girders, and Cast-Iron Tank complete. The Plant can be seen by appointment with the Manager.

Sealed Tenders, endorsed "Holder," to be delivered to me on or before Monday, April 18 next.

The Directors do not bind themselves to accept the highest or any Tender, and reserve the right of accepting the whole or a portion only of any one Tender.

By order,
GEO. H. SAYERS,
Secretary.

Gas Offices: The Causeway,
Near Staines, March 25, 1904.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

TO SUBSCRIBERS.
ROBERT DEMPSTER & SONS, LTD., of Rose Mount Iron-Works, Elland, Yorkshire, beg to inform Subscribers to the "JOURNAL OF GAS LIGHTING," that the series of COLLOTYPE VIEWS OF GAS PLANT executed by them is being issued in the form of inserted sheets fortnightly, Seven of which have already been published, and respectfully suggest that SUBSCRIBERS SHOULD PRESERVE THE WHOLE SERIES FOR FUTURE REFERENCE.

FOR Immediate Disposal—all in Good Condition—Two PURIFIERS, 6 ft. square; SCRUBBER, Cast-Iron, 20 ft. by 3 ft.; HOLMES WASHER, 6-inch Connections; 6-in. COWAN'S GOVERNOR and STATION METER; IRONWORK of Three Settings of Five Retorts 15 in. by 21 in., with Hydraulic Main. 6-inch PIPE CONDENSERS.
Apply, by letter, to No. 4193, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF CHORLEY.

GAS-WORKS.

THE Corporation have for Sale a Reciprocating GAS-EXHAUSTER with STEAM-ENGINE. Capacity about 25,000 cubic feet per hour. The Exhauster can be seen, and Particulars obtained, at the Gas-Works, Water Street, Chorley.

Offers for the purchase of the above to be delivered to the undersigned not later than Tuesday, April 19, 1904, endorsed "Machinery."

The Corporation do not bind themselves to accept any Offer.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley, April 6, 1904.

KIDSGROVE GASLIGHT COMPANY.

TENDERS are invited for the supply of about 4000 Tons of GAS COAL to be delivered at these Works during the Twelve Months ending June 30, 1905.

Sealed Tenders, on Contractor's own Form, to be addressed to the Chairman, and delivered to me not later than April 30.

JAMES BEECH,
Manager and Secretary.

Gas-Works, Kidsgrove.

MANCHESTER CORPORATION.
(GAS DEPARTMENT.)

CONTRACT No. 1.

TO CONTRACTORS FOR INCLINED RETORT INSTALLATIONS.

THE Gas Committee are prepared to receive TENDERS for an Installation of INCLINED RETORTS, to be constructed and set to work at their Gaythorn Station.

General Conditions of Contract and Specification may be obtained on application to Mr. C. Nickson, Superintendent, Gas Department, Town Hall, on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

Drawings may be seen, and any other Information obtained, on application to Mr. J. G. Newbigging, M.Inst.C.E., at his Office, Rochdale Road Station.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, enclosed in official envelope, addressed to the Chairman of the Gas Committee, and endorsed "Tender for an Installation of Inclined Retorts, Gaythorn Station," must be delivered at the Gas Office, Town Hall, Manchester, not later than Twelve Noon on Thursday, the 21st day of April, 1904.

By order,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
April 8, 1904.

MANCHESTER CORPORATION.
(GAS DEPARTMENT.)

CONTRACT No. 2.

TO IRON AND STEEL WORK CONTRACTORS.

THE Gas Committee are prepared to receive TENDERS for the IRON and STEEL WORK required for an Installation of Inclined Retorts at their Gaythorn Station.

General Conditions of Contract and Specification may be obtained on application to Mr C. Nickson, Superintendent, Gas Department, Town Hall, on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

Drawings may be seen, and any other Information obtained on application to Mr. J. G. Newbigging, M.Inst.C.E., at his Office, Rochdale Road Station.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, enclosed in official envelope, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Iron and Steel Work, Inclined Retort Installation, Gaythorn Station," must be delivered at the Gas Office, Town Hall, Manchester, not later than Twelve Noon on Thursday, the 21st day of April, 1904.

By order,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
April 8, 1904.

LEEDS CORPORATION GAS-WORKS.

THE Gas Committee are prepared to receive TENDERS for the supply of CAST-IRON PIPES, RETORT CASTINGS, &c.

Samples may be seen on application at the Stores Department, 21, Dewsbury Road, and Forms of Tender and Specification may be had on application to the undersigned.

Endorsed Tenders, addressed to the Chairman of the Gas Committee, Gas Offices, East Parade, Leeds, must be delivered not later than Monday, the 25th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. TOWNSLEY,
General Manager.

Gas Offices, Leeds, April 9, 1904.

RICKMANSWORTH GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 2000 Tons, or thereabouts, of South Yorkshire Screened SILKSTONE NUTS and Staffordshire Screened WASHED NUTS, to be delivered free at Rickmansworth (Metropolitan Station) in such quantities and at such times as may be required.

The Directors reserve to themselves the right to accept any Tender. No special Form necessary.

Quotations, endorsed "Tender for Coal," to be sent to the undersigned not later than the 27th inst.

HENRY HILL,
Engineer and Manager.

The Gas-Works,
Rickmansworth, Herts.

ASHFORD (KENT) URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Lighting Committee are prepared to receive TENDERS for the supply of 6200 Tons of good GAS COAL.

Forms of Tender and other Information can be obtained on application from J. Morton, Manager, Gas-Works.

Tenders, endorsed "Coals," must be delivered on or before Wednesday, April 20, 1904, at the Office of the Gas-Works, Ashford, Kent.

JOHN MORTON,
Manager.

April 9, 1904.

AMENDED ADVERTISEMENT.

BRADFORD CORPORATION ELECTRICITY WORKS.

STORAGE RESERVOIR AND RIVER RETAINING WALL.

THE Corporation of Bradford are prepared to receive TENDERS for the Construction of a STORAGE RESERVOIR near Canal Road, and a RETAINING WALL to be erected there to divert the channel of the Bradford Beck.

The Reservoir will be 320 feet in length, and have an average width of 160 feet, and be 10 feet deep or thereabouts from floor level to level of top of cope; and the Works will include Excavations, Embankments, Roads, Masonry, Concrete, Brick, Timber, Iron Work, Valve Chambers, River Sluices, Valves, Railings, Pipes, Standards, Floats, Screens, Parapet Walls, &c.

Drawings may be seen, and printed copies of Specification and General Conditions, Form of Tender, &c., may be obtained at the Office of the Water-Works Engineer, Town Hall, Bradford, on payment of the sum of £5, which sum will only be returned on receipt of a *bonâ-fide* Tender and the return of all documents.

The Contract will be let subject to the Fair Contracts Clauses of the Corporation, which may be seen at the Town Clerk's Office, and which the Contractor will be required to sign.

Sealed Tenders, on the Form supplied, together with the Conditions of Contract, Specification, and Schedule of Quantities, must be sent in intact, fully filled up, to the Town Clerk, Town Hall, Bradford, not later than Ten a.m., on Thursday, the 28th day of April, 1904, endorsed "Storage Reservoir, &c., Tender."

The Corporation do not bind themselves to accept the lowest or any Tender.

FREDERICK STEVENS,
Town Clerk.

Town Hall, Bradford,
April 8, 1904.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

SALE OF £50,000 ORDINARY STOCK.

THE Directors offer for Sale by Tender £50,000 ORDINARY STOCK, to be issued under the provisions of the Newcastle-upon-Tyne and Gateshead Gas Act, 1901. Applications receivable up to Ten a.m. on the 13th of April, 1904.

When Gas is charged at the present rate of 2s. per 1000 cubic feet, the Authorized Dividend is £4 12s. 6d. per cent.

Any amount of Stock, being not less than £5, or a multiple thereof, may be applied for. A deposit of 5 per cent. on the nominal amount of Stock applied for must accompany each Tender, and the balance be paid on or before the 30th of June, 1904. Interest at the rate of 4½ per cent. per annum will be allowed upon prepayments.

MINIMUM PRICE, £105 10s. PER CENT.

The Company's profit for the year 1903 was £112,106; and after paying all interest and full statutory dividends, there was left a surplus profit of £24,658.

During the last five years, the number of consumers has increased by 26,276, and the gas sold by 425,177,000 cubic feet.

Prospectuses and Forms of Tender will be sent on application to the undersigned.

THOS. WADDOM,
Secretary.

Newcastle-upon-Tyne,
March 29, 1904.

BOROUGH OF COLNE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the surplus TAR made at their Works during the Twelve Months ending March 31, 1905.

Particulars may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Tar," must be addressed to the Chairman of the Gas Committee, Gas-Works Knotts Lane, Colne, Lancs., and delivered not later than Monday morning, the 18th of April, 1904.

The highest or any Tender not necessarily accepted.

FRED. THORPE,
Engineer and Manager.

Gas-Works, Knotts Lane,
Colne (Lancashire),
April 5, 1904.

COUNTY BOROUGH OF BURY.

TO SULPHURIC ACID MAKERS.

THE Gas Committee are prepared to receive TENDERS for the supply of about 400 Tons of SULPHURIC ACID for the Manufacture of Sulphate of Ammonia, for a period of One Year from the 1st day of May, 1904.

Forms of Tender and Conditions may be obtained on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

Sealed Tenders, endorsed "Tender for Acid," to be addressed to the undersigned on or before Monday, the 18th inst.

JOHN HASLAM,
Town Clerk.

Municipal Offices: Bank Street,
Bury, April 7, 1904.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 3rd of May next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 31st of December, 1903, and the usual Ordinary Business of such Meeting transacted.

Notice is Hereby also Given, that the CAPITAL STOCK TRANSFER BOOKS WILL BE CLOSED from the 19th inst. to the 3rd prox., both days inclusive.

The Dividend will be paid on the 10th of May.

By order of the Board,
ROBERT W. WILSON,
Secretary.

21, Austin Friars, London, E.C.,
April 11, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £12,500 ADDITIONAL "B" CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, April 25, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

LOWESTOFT WATER AND GAS COMPANY.

SALE BY AUCTION OF 400 ADDITIONAL ORDINARY £10 SHARES,

Ranking for 7 per cent.; the dividend on similar Shares in the Company having been 5¾ per cent. for several Years past; also

£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, London, E.C., on Monday, April 25, at Two o'clock, in Lots, by Order of the Directors.

The Company, incorporated in 1853, supply Water and Gas in Lowestoft and the surrounding District. The Water-Rental in 1891 was £7146, in 1903 it was £15,122; and the Gas consumption has advanced from 43 million cubic feet in 1891 to nearly 77 millions in 1903.

New Works to keep pace with the increasing demand for Water and Gas are necessary; and it is for these Works that the new Capital is being raised.

Particulars of Sale, and Form of Instructions for the Auctioneer or Secretary to purchase for Investors unable to attend the Auction, obtainable, post free, of the SECRETARY of the Company, 137, London Road, LOWESTOFT, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

SOUTHEND WATER-WORKS COMPANY.

173 £10 NEW ORDINARY FIVE PER CENT. SHARES AND 15 £10 ADDITIONAL ORDINARY SEVEN PER CENT. SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, April 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TAR Contracts Wanted on the Sliding-Scale or at Fixed Prices.
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

PURIFIERS.

THE Salisbury Gas Company invite TENDERS for supplying and erecting, on Foundations provided, two PURIFIERS, each 27 feet by 18 feet, luteless Covers, Grids, Valves, Connections, and Travellers, complete ready for use.
Plans and Site may be inspected on application to N. H. HUMPHRYS, Gas Engineer, SALISBURY, to whom Tenders should be sent not later than the 18th inst.

BRIDGEWATER COLLIERIES COKE-WORKS.
(THE EARL OF ELLESMERE).

TENDERS are invited for the Light Oil produced at the above Works for a period of Six or Twelve Months from the 1st of May, 1904, delivered into contractor's tanks at the Bridgewater Colliery Siding, Wharton Hall, on the Pendleton and Hindley branch of the L. & Y. Railway; or at the Brackley Siding, on the Little Hulton Mineral branch of the L. & N. W. Railway.
Tenders, endorsed "Tenders for Light Oil," to be addressed to Mr. THOMAS M. BROWN, Bridgewater Coal Office, 4, Chapel Walks, MANCHESTER, on or before the 16th of April.

TENDERS FOR GAS COAL.

THE Brentwood Gas, Coke, and Light Company, Limited, are prepared to receive TENDERS for the supply of 6500 Tons of good, clean, fresh-worked GAS COAL, screened and unscreened, for the Year ending April 30, 1905.
Deliveries to be free to Brentwood Station (G.E.R.), in trucks with a door at one end, in quantities to be subsequently determined.
Not less than 2000 Tons of any one description of Coal will be taken.
No Form of Tender issued.
Tenders to be delivered to the undersigned on or before Friday, April 29, 1904.
The lowest or any Tender not necessarily accepted.
C. A. FIELDER,
Secretary.
Brentwood, Essex,
April 8, 1904.

A 4pp. 8vo. Leaflet. Price, 10s. 6d. per 100.

"Agricultural Value of Gas Lime."

A Paper read by Mr. CHARLES D. PHILLIPS, J.P., a Director of the Newport Gas Company, before the Monmouthshire Chamber of Agriculture.
Reprinted from the "JOURNAL" for Oct. 13, 1903.

WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

NOTICE.

THE ORIGINAL AND ONLY

"HUMPHREY" Gas Arc Lamp

Is covered by Patent No. 14,418 of 1902, and by design patents Nos. 393,015 and 393,016.

All persons are warned against the Manufacture, Sale, or Purchase, of Gas Arc Lamps infringing these Patents.

The "HUMPHREY" GAS ARC LAMPS, for both inside and outside lighting, are for sale by **All Dealers in Gas Fixtures** in Great Britain; and Illustrated and Descriptive Circulars can be obtained free on application to—

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No. 36.] [*Tuesday, April 12, 1904.*

Seasonable Efforts.

We need hardly remind our indulgent readers what can and should be done at this time of day. Gas Managers have no excuse for shutting their eyes, but every one for keeping them open—and one of them fixed on civic requirements and civic aspirations in the matter of illumination. Very much depends upon the Gas Manager's ability to meet his principal customer halfways, upon his initiative and perspicacity. The notion that business is simply "handing over the counter what is asked for," is too elementary to need refutation at this moment. Yet there can be no doubt that many of us have some difficulty in living up to the more complex standards of commercial life. If we lose ground at any time, it is practically certain it is due to **lack of imagination.** It is the ability to foresee changes, to forestall coming developments that marks the man of real capacity, whether in commercial, industrial, or other walks of life. It is dangerous to be too late! Well, the standards of yesterday are rapidly being discarded—they want more light all over. If you do not realize this to day, somebody else will realize it to-morrow. And it is better for your gas company, better for the gas industry that **you** should be the one to **say it.** Do not be too slow to suggest; do not fail to use every opportunity of improving the public lighting. A fine street lighting is the most effective advertisement possible. And a 200-candle lamp is every day better than a 100-candle one.

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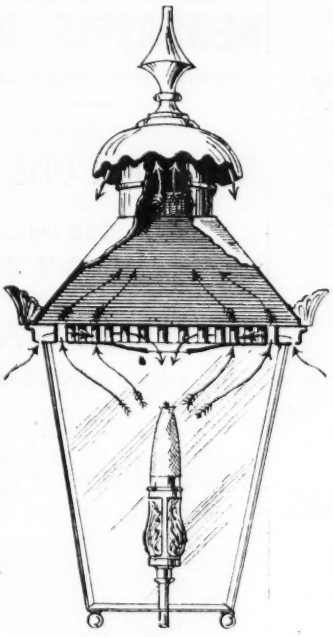
The "GALE-PROOF" LANTERN.



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Dust, Gale, and Insect Proof. Regenerating and Self-Intensifying.

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Cure for all "Wind" troubles.

The "JOURNAL" of March 22—

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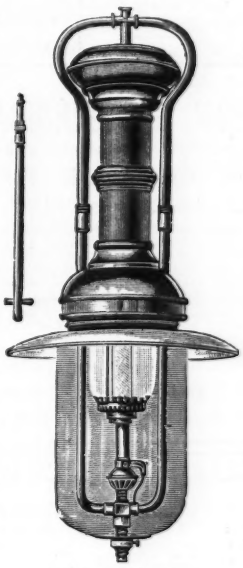
The "WIS" HIGH-POWER LAMP.



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The Syndicate is prepared to entertain offers of sale of small Gas-Works, whether profit earning or not.

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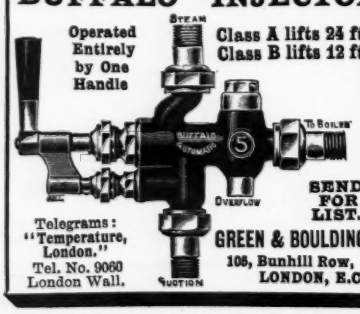

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Rich in Illuminating Power and yield of Gas.
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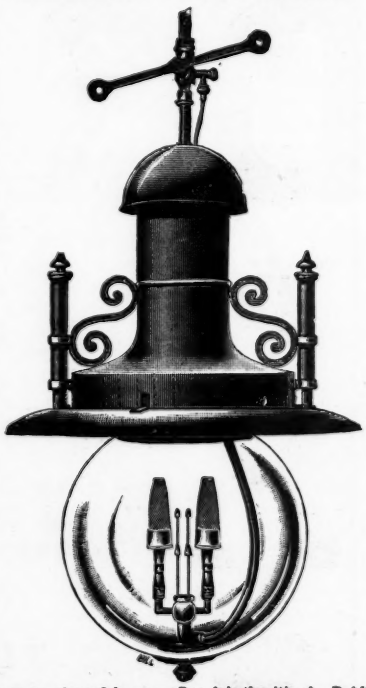

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3 gallons Tar and 20 lbs. Coke produce 1000 cubic feet 10 to 12 Candle Power Gas of the following composition—

Hydrogen	64·4 per cent.
Methane	12·0 „ „
Unsaturated Hydrocarbons	3·0 „ „
Carbon Monoxide	15·0 „ „
Nitrogen and Carbon Dioxide	5·6 „ „
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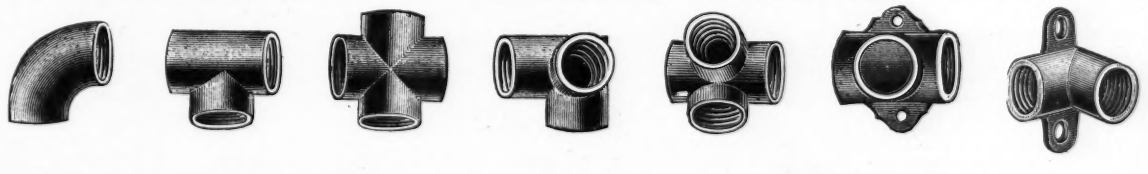

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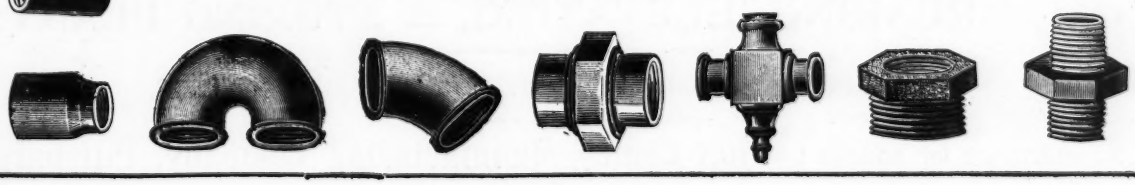

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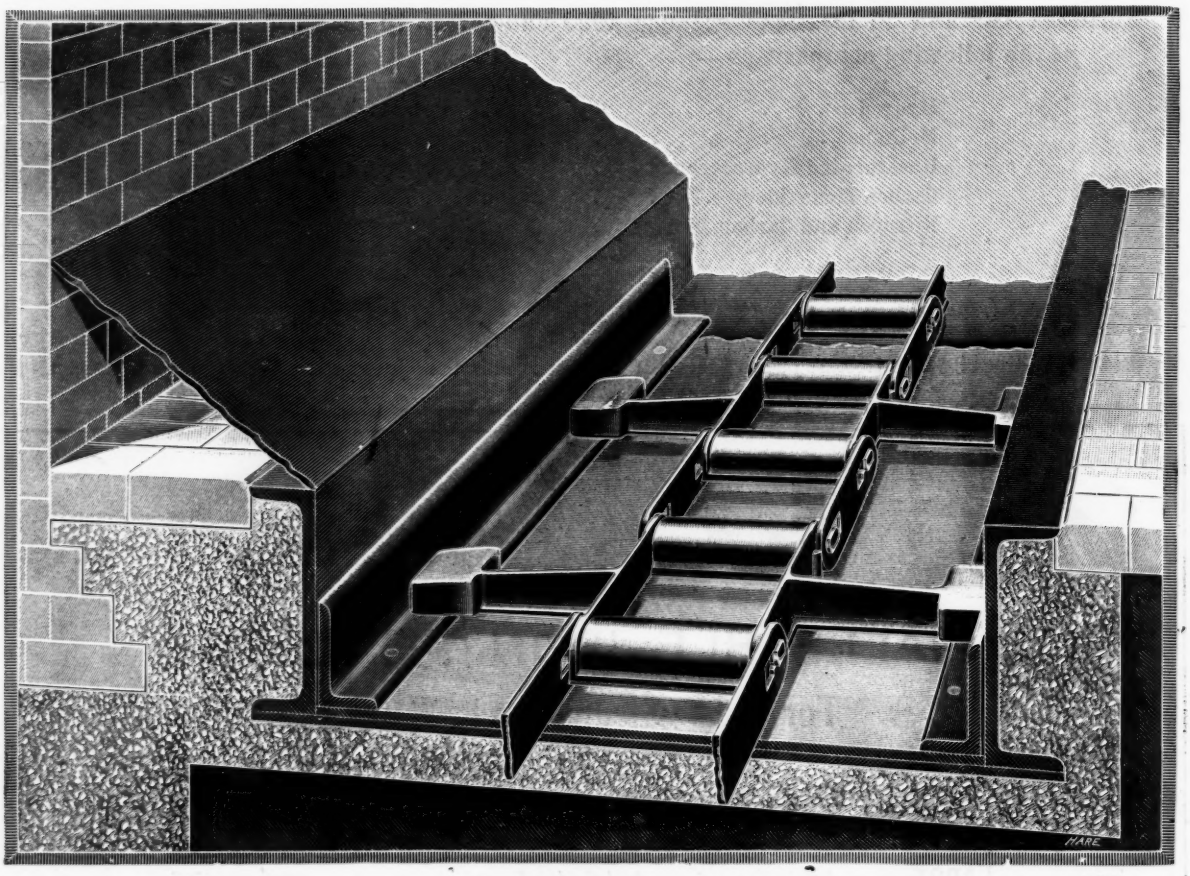

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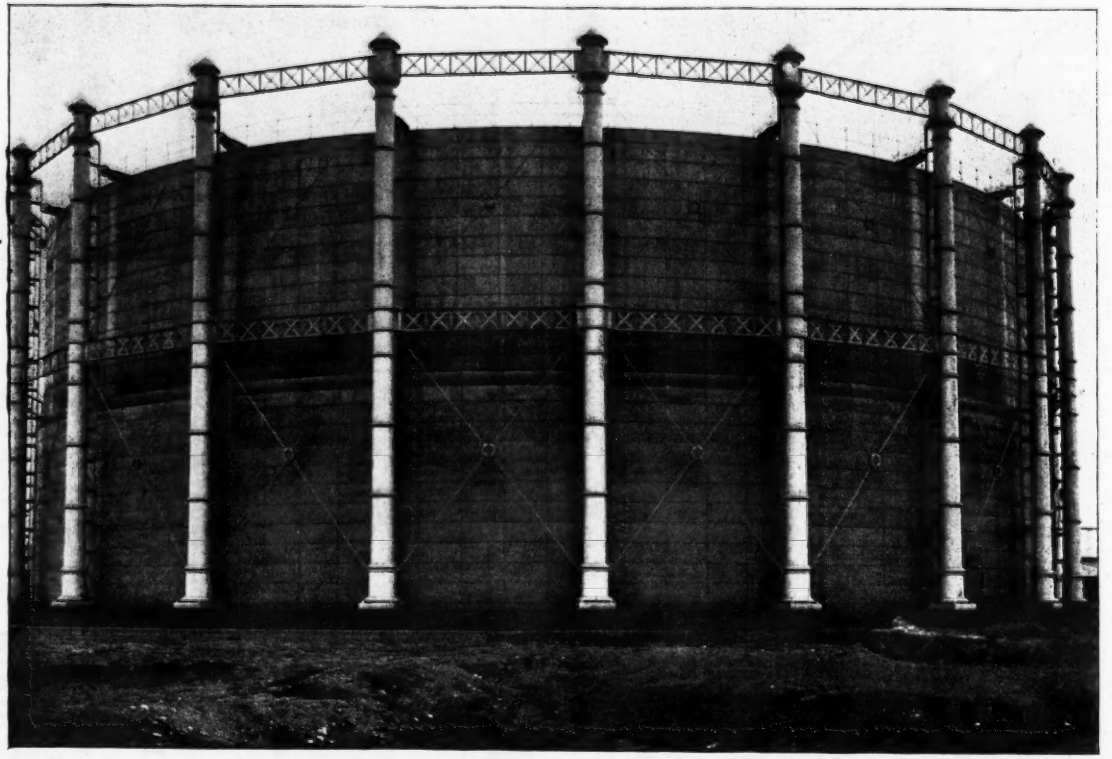

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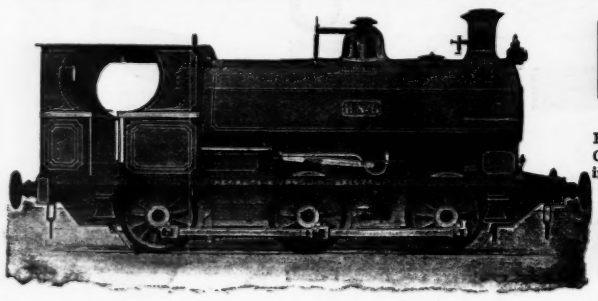

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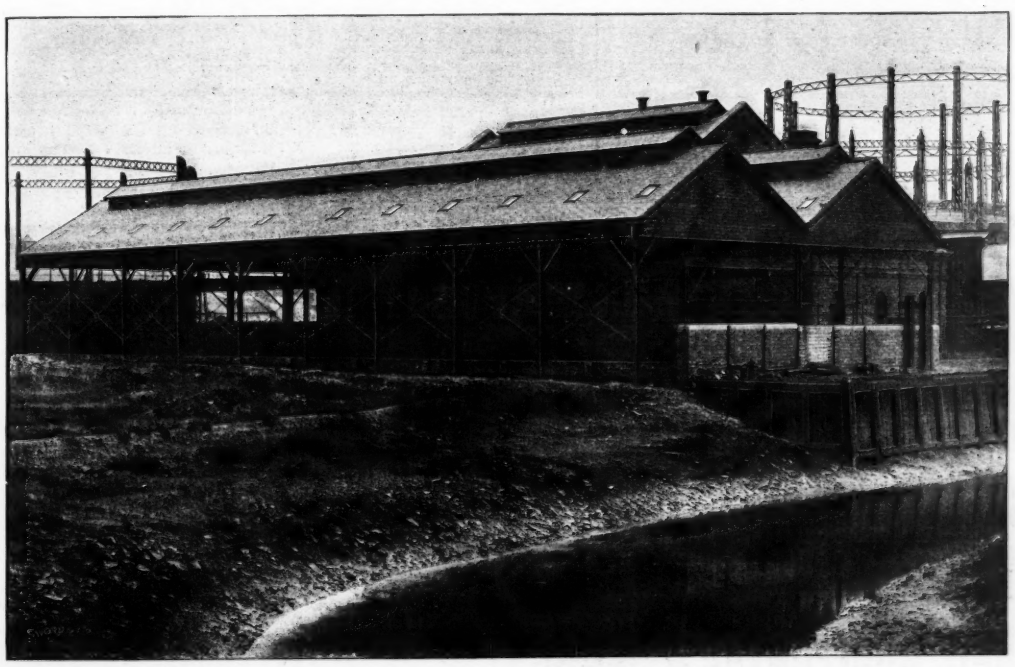

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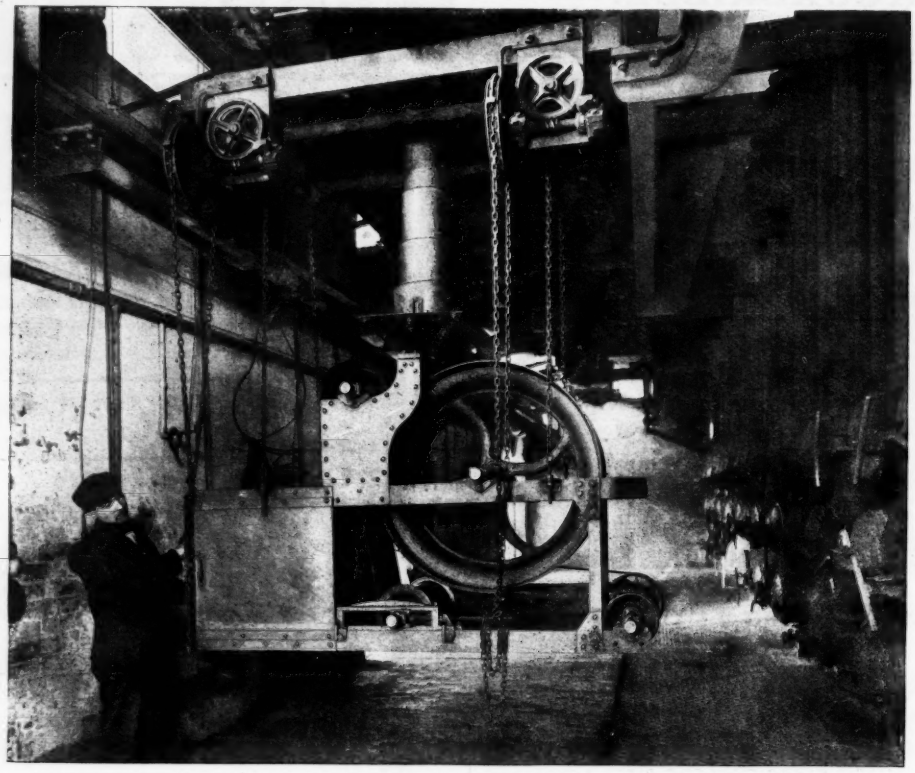

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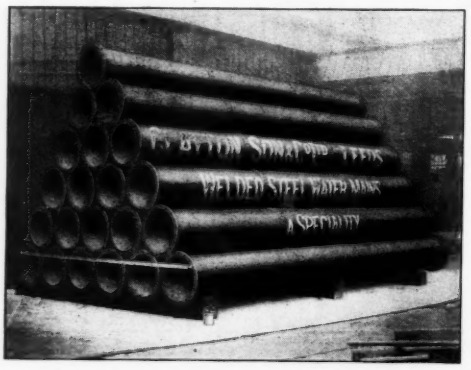

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